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The Outlook

Grand Strategy

MR. CHURCHILL'S speech on January 27th was a candid review of the whole grand strategy of the war, and yet it had surprisingly little in it about the air. The Prime Minister frankly admitted that because the United States and ourselves had temporarily lost command of the seas in the Pacific, and that command had passed to Japan, the third strongest naval power in the world, she would be able to inflict "very heavy and painful losses" on the United Nations (that expression is to take the place of "Allies") which have possessions there. Yet it was the clever use made of aircraft by the Japanese which altered the naval situation. We know from the report of the American commission that proper precautions were not taken at Pearl Harbour; we have not yet been told why the *Prince of Wales* and *Repulse* did not receive fighter protection (which was within reach) at the time when the Japanese attacked them. But the Prime Minister was obviously right when he pointed out that the dispersion of the Japanese forces on many islands will be a source of weakness to them once the United Nations have regained command of the seas.

Mr. Churchill is as much alive as any man to the importance of air power, and he was able to tell the House that before he left for America on December 12th he had arranged for the despatch of air reinforcements to Malaya and Burma. These have already made themselves felt, and the Japanese losses in aircraft have been mounting. The sight of them has also cheered up the regiments, British, Australian and Indian, who have been fighting so gallantly down the Malay peninsula. What else he has sent he naturally did not tell the House of Commons, but it is not to be supposed that H.M.S. *Duke of York* took the Prime Minister to the United States as a sort of luxury cruise.

Bomb Loads, Speeds and Altitudes

WE have been astounded of late to observe the loose figures that are constantly being quoted about bomb loads and speeds of different aircraft in the American journals—always with the idea of showing the superiority of American products. For instance, in reviewing the features of the Stirling, our usually well-informed contemporary *Aviation* under its "Foreign Flying Equipment" says:—

> "The Stirling, built like a flying box car, must be capable of carrying a bigger bundle of bombs to Berlin, something like 6,000-7,000lb. The Fortress Model C carries about 4,800lb. . . . British pilots (not the magazine writers) are credited with saying that at high altitudes the Boeing was definitely better than the Stirling or Halifax, and that at 25,000 feet they found it to be even faster than the Spitfire or Hurricane."

Our rejoinder to the latter paragraph would be, "Follow the magazine writers!"—although they are often checked by secrecy rules from giving all the facts.

Another curious observation in the same article is the following:—

> "Undoubtedly no Boeings have been lost because they can reach altitudes in excess of effective ground fire, and although ME.109 Fs. have engaged Fortresses in combat at 40,000 feet, the Nazi fighters find it difficult to manœuvre at that altitude."

A few weeks ago an extraordinary effusion by W. L. White in the *Saturday Evening Post* said:—

> "British bomber pilots who do the actual dying have taken the American Flying Fortress up, have seen that they carry on long raids five times the bomb load of the

standard British bomber, carry it higher, faster, further and with infinitely less risk to the crew" . . . . "She has no fear of ice, which drags dozens of Whitleys down, for she can rise effortlessly above it" . . . . "The British pilot of the Flying Fortress made actual rings around the other two (a Hurricane and a Spitfire)." The crew said, "We think this is the finest four-motor bomber there is, definitely better than the Stirling and the Halifax."

Such language may be picturesque, though it is quite unconvincing to those "in the know," but one cannot wonder any longer at the misconceptions that exist, when misleading statements of this character are published in widely read journals. Friendly rivalry is all to the good, but for our part we deprecate these invidious comparisons, mostly based upon uncorroborated figures and tittle-tattle. It is futile and getting us nowhere. The war is too grim for internal controversies of this nature, but idle boasting and misleading comparisons have become so frequent in American journals that one is tempted to suggest a halt. One could so easily refute some of the claims if more pressing problems were not at hand. America owes a great deal to Britain in aircraft technical and operational progress, and this country owes a great deal to America. This is as it should be with progressive countries united and collaborating in a common task.

We commend to the notice of our readers the more rational, sober and well-considered views of Edward P. Warner, quoted in this issue. Mr. Warner has worked in aviation for a quarter of a century. A former editor of *Aviation*, he is the author of a number of very excellent books on aircraft design, is a Fellow of our own Royal Aeronautical Society, is vice-chairman of the American Civil Aeronautics Board, and was technical assistant to Mr. Averell Harriman on the latter's recent visit to this country.

Lord Trenchard's Strategy

FOR about two years in the last war our army in France was short of shells, and there was a great outcry. In this war all our armies, except in the Middle East, have been short of aircraft, and again there is a great outcry.

Lord Trenchard, in his speech of January 29th, impressed upon the House of Lords that the Army, and the Navy in narrow waters, could not fight successfully without air cover, while at the same time the Prime Minister in "another place" was excusing the late Admiral Philips for taking the risk of doing so. The Army has tried to do so several times, with unpleasant results.

It may be felt, however, that Lord Trenchard went too far in laying it down that "air must dominate strategy." Other enthusiasts might claim the same for the tank or some other weapon. After all, when one boils down Lord Trenchard's speech and those of other public men, the conclusion is that a fighting force should be properly equipped in all respects, and aircraft are very essential weapons. Lord Trenchard himself admitted (what *Flight* has always maintained) that the air could not win the war without the Army and the Navy, an admission which supports the doctrine of combined use of all arms.

BRITISH AND AMERICAN SERVICE CHIEFS CONFER IN WASHINGTON: Air Chief Marshal Sir Charles Portal and General Arnold appear ammunition-minded in this picture. The sizes they are contemplating range from rifle calibre machine gun cartridges to 37 mm. shells.

A formation of Bristol Beauforts off to keep a date with the Huns.

Air Work in Russia : A.A. Guns in Burma and Malaya : More Hurricanes in the Far East : Fighters v. Tanks in Libya

OF late the Russian Air Force has been figuring in the communiqués more than it did a short while ago. As an example we may quote from the Russian communiqué relating to the fighting on January 27th. It says that "our air squadrons destroyed 13 German armoured cars, 334 lorries loaded with infantry and supplies, more than 50 cartloads of ammunition, nine guns with their crews, and 10 A.A. machine guns, set fire to two military trains, and decimated four battalions of enemy infantry." It should be noted that the Red Air Force sticks closely to its allotted rôle of an arm of the army, and is not diverted from the battlefield (except very occasionally) to strike at targets in Germany. Of course, the bases from which Russian bombers could now start are a long way off from the German frontier, but all the same the Russian Air Force has stuck pretty closely to the one policy throughout the war. Its main job is to prevent reinforcements, ammunition, and other supplies from reaching the German firing lines, in accordance with the principle that when a battle is in progress all air strength must be concentrated on the battlefield, including—in fact paying particular attention to—the enemy's rear. Where the artillery can tackle a situation, the bombers are well advised to leave that situation to the guns.

It is gratifying to know that British aircraft are playing a worthy part in this great work. Mr. Churchill took a great strategic decision when he, together with President Roosevelt, decided that help for Russia must be one of our primary objects. He sketched his whole strategic conception in the House of Commons in the debate of January 27th. Briefly, it was that the United Kingdom must be held, that the lifeline across the Atlantic must be protected, that Russia must be kept supplied with arms, and that what resources were left over must go to checkmate the double threat on Egypt, Iran and Iraq from the Caucasus and from Libya. For the Far East he could spare two capital ships, which, alas, are no more, but for the rest the Pacific was the concern of the American Navy—now * partially crippled. Russia had the only army which could, with due munitionment, hold and perhaps defeat the great German army, and, therefore, we must deprive ourselves of tanks and aircraft which we sorely needed in order to keep that army in being. Now it is in winning mood, and Sir Stafford Cripps has said that the Russian leaders expect to have settled with the German army, and with Germany herself, by next autumn or winter. We all hope that these expectations are not exaggerated, and there is no obvious

RUSSIAN INTERIOR: The pilot and navigator in a P.E.2 twin-engined bomber as seen from the bomb aimer's prone position.

WAR IN THE AIR

reason why they should not be fulfilled. If it should come about that the Russians enter Berlin before next Christmas, we hope that British-built Hurricanes will fly overhead, and that Matilda tanks will waltz down Unter den Linden.

Fortunately, we have a good supply of Hurricanes, despite our gifts to Russia, and we have been able to send some out to Malaya and Burma. At first the air defences in those countries consisted chiefly of A.A. guns. Those guns had really surprising successes in the number of Japanese aircraft which they brought down, and the tale suggests that Japanese bomber pilots are lacking in guile, and run risks and offer themselves as easy targets in a way which does more credit to their pluck than to their fighting skill. They also had poor success in bombing targets of military importance, though they killed a lot of civilians in Singapore. In Burma we owe a big debt to the body of American volunteer airmen who undertook to defend the Burma Road, but came to the help of Rangoon when the Japanese began to bomb the city. The arrival of Chinese troops to help in the defence of Burma is also a fine chivalrous gesture on the part of General Chiang Kai Shek.

The Libyan Battle

ROMMEL, who has been promoted to Colonel-General, has received some reinforcements and has turned against his Empire pursuers. His troops surrounded Benghazi and naturally occupied it. Not long ago our chief fear was that Rommel would escape with the remnants of his heavy tanks and other forces. Now he is not trying to escape. That gives us another chance to overwhelm him, provided that we command enough weight of metal to do so. It is annoying to lose Benghazi once more, and we must have lost some troops as prisoners, but it must never be forgotten that our object in this battle has not been so much the gaining of territory as the destruction of the enemy's forces.

One cannot withhold admiration from the crews of the enemy transport vessels which have been daring the dangerous waters between Europe and Africa to carry reinforcements of men and material to Rommel. The percentage which fell victims to the R.A.F., the submarines, and sometimes to squadrons of naval warships, must have appalled many hearts in Italy and Sicily. But still the convoys came on, and many ships got through.

Then long desert columns had to face the furious attacks of the Empire air forces as they made their way from the port of disembarkation up to the front. There, too, the carnage and destruction was terrifying, but still much got through. Over parts of the desert the convoys were not obliged to stick to the roads, but could take their

ONE LESS: Russians dismantling a Messerschmitt 109 brought down on the Moscow front.

BATTLEFIELD BRIEFING: A shirt-sleeved Wing Commander telling air crews the details of an operation over Libya.

FLAMING RICOCHET: A remarkable photograph of an Axis bomber which had been shot down in flames over the Mediterranean, bouncing off the water and about to make the final plunge.

own line. The Empire air forces could not be everywhere, and good use must have been made of the hours of night.

Recent reports suggest either that a considerable part of the enemy reinforcements were medium or light tanks, or else that some new types of fighter aircraft have recently been sent to the help of Air Vice-Marshal Coningham, for there has been repeated mention lately of successful attacks on armoured vehicles.

American Fleet in Action

IT is extremely refreshing to hear that the American fleet has begun to take an active part in operations in the Pacific. The first mention of U.S. warships was that cruisers as well as destroyers and aircraft took part in the attack on the large Japanese convoy in the Strait of Macassar. This fight went on for five days, and the damage done to the enemy was much heavier than was at first reported. At least one capital ship, probably an aircraft carrier, was sunk.

Then, either in the last days of January or on February 1st (the date was left uncertain), U.S. warships and aircraft (again we must assume carriers) made a surprise attack on Japanese naval and air bases in the Gilbert and Marshall Islands in the Western Pacific. The Marshall Islands are a Japanese mandate, and it was from bases there that the attacks on Wake and Midway Islands were launched. The Gilbert Islands are a British possession. Japanese fleet auxiliaries were sunk, military installations ashore were both shelled and bombed, and many enemy aircraft were destroyed in the air and on the ground. The Americans lost 11 aircraft and two of their ships suffered minor damage.

The composition of this American force has not been stated, but its sudden appearance indicates that it felt no fear of being overwhelmed by the Japanese battle fleet, either because it knew that the latter was too far distant or because it was itself protected by battleships. The distances in the Pacific are great, and rapid movements of ships from one point to another are not to be expected. But now at last the U.S. fleet is beginning to make itself felt, and the days are drawing to a close when the Japanese could steam wherever they liked and land troops here, there and everywhere without interference.

The Empire forces have evacuated the mainland of Malaya and retired to the island of Singapore. The causeway connecting the island with the mainland has been blown up. The next stage will probably be a struggle for air superiority. The A.A. guns of the island have kept the enemy bombers at a height from which accurate bombing of targets was impossible. Hurricanes have been active in attacking the raiders, and the pilots are confident that with more fighters of that class they could break up the Japanese formations. Reinforcements have recently reached the island.

BRITISH AIR LOSSES TO JAN. 31st.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent Ftrs.	Middle East A'crft.	Far East A'crft.
Jan. 25	0	0	0	6 (4 p'lts safe)	0
,, 26	2	3	0	1	1
,, 27	0	0	0	1	0
,, 28	0	6	1	2	1
,, 29	0	0	1	1	0
,, 30	0	0	0	1	1
,, 31	0	5	0	1	No report
	2	14	2	13	3

Totals: North, 3,200; Middle East, about 921; Far East, 19.

ENEMY AIR LOSSES TO JAN. 31st.

	Over G.B.	Over Continent	Middle East	Far East
Jan. 25	1	0	3	3
,, 26	0	0	1	17
,, 27	0	0	2	3
,, 28	0	0	1	10
,, 29	0	0	0	15
,, 30	0	0	0	1
,, 31	0	0	0	No report
	1	0	7	49

Totals: North, 5,619; Middle East, over 3,452; Far East, 154.

GIVING HIM A TIP: A South African pilot who hails from Zululand examining the damage received from ramming a Fiat G.50 in the air. The portly gentleman in War Correspondent's attire is Quentin Reynolds.

NO NATIONAL MONOPOLY

Edward Warner's Sane Views on British and American Aircraft and Engine Design : Ill-informed Writers Confounded

WHEN America began to supply Great Britain with much-needed additional aircraft it was natural, so great was the interest of the general public in this phase of the war, that comparisons should be drawn between the types produced by our own industry and those reaching the R.A.F. from across the Atlantic. Unfortunately, this widespread public interest in the aircraft taking part in the country's defence encouraged the pseudo-expert to turn out a flood of misleading—and often wholly inaccurate—information through the columns of the non-technical Press. From time to time fantastic figures have been quoted about bomb-loads, speeds, altitude and other vital factors which, just because they appeared in print, were given an entirely false impression of authenticity.

Some of these ill-advised articles have apparently been inspired by a desire, on the part of their authors, to prove that the aircraft of their own country were far superior to those of any other, while some of them, it is to be feared, have been the outcome of a resolve to "get a story" at any cost. In both cases they have been all too clearly written by persons ignorant of the true facts, and a great deal of harm has been done on both sides of the Atlantic.

That being so, the article by Mr. Edward Warner in the December issue of our American contemporary, *Aviation*, is particularly opportune. Mr. Warner is vice-chairman of the Civil Aeronautics Board and was formerly Technical Assistant to Mr. W. A. Harriman on the British Mission. A former editor of *Aviation*, he has made aviation his life work and has been responsible for many important contributions to its progress during the past quarter of a century.

Pointing out that the basic facts are those that relate to the general quality of the aircraft and their fitness for specialised military service, Mr. Warner says:

"Contrary to frequent allegations of national self-exultation or of national self-depreciation, there is neither general and continuing virtue, nor general and continuing defect, in American aircraft, nor in British, nor in German. Research goes on in all the major nations. Aeronautical engineering follows the same general methods, uses much the same data, and is subject to the same physical laws in all. In all these countries, men of great ability have applied their talents to the design of aircraft and their engines and their auxiliaries, and to the improvement of the methods of producing the equipment."

No Inherent Superiority

Saying that, for certain reasons, America could claim to have led the way in introducing important new features into aircraft design during the past few years, Mr. Warner adds, "I would not venture, however, to extend that claim into a claim of any general and inherent superiority for the American product. Still less could any general inferiority be truthfully admitted."

Then he goes on to put his finger on a vital aspect of the matter, complete failure to appreciate which is probably at the root of most of the misinformation poured out by the pseudo-experts. "There are many instances," he says, "of the application of particular efforts, in one nation or another, to the solution of a particular problem on the development of a particular type. A few of the more conspicuous instances of that sort may be mentioned—instances in which we have followed one line of development, while the British, or perhaps all of Europe, have followed another, with the result that *for certain special purposes* (the italics are Mr. Warner's own) our aircraft do possess special advantages, while in other respects they work under special handicaps."

As the first of such instances Mr. Warner mentions the heavy bomber, and points out that, while Britain has at least two excellent four-engined types in regular service, her chief line of development has been in smaller, two-engined types. In America, on the other hand, the large four-engined bomber, "colloquially known as the flying fortress," has been given consistent priority for at least the past five years. The four-engined bomber is now recognised to have a number of special advantages for the present type of operations.

"Another interesting point for illustration, and one that has been the occasion of some intensely acrimonious public discussion by aeronautical writers, concerns the power plant," continues Mr. Warner.

British Fighter Advantage

"Both America and Britain build both air-cooled and liquid-cooled engines; but the concentration of effort upon the air-cooled types has been more intense in America than in Europe. . . . But the British have built many more liquid-cooled engines than we have, and they have advanced more rapidly in increasing the power of the individual engine towards the present maximum of some 2,000 h.p. Since most high-performance fighting aircraft are designed around liquid-cooled engines, our less intensive activity on that type of engine has imposed limitations on fighter development. . . . We lack the British advantage of continuous development and large-scale application over the past decade."

A third point selected by Mr. Warner is that of designing engines for maximum performance at high altitudes, which brings him to the question of superchargers and the choice between the type built into the engine itself as primarily favoured in this country, and the exhaust-driven turbo-supercharger upon the development of which American aircraft engineers have, to their great credit, spent much time and effort.

"The auxiliary supercharger driven by an exhaust turbine," he says, "is already making it possible to conduct bombing expeditions at altitudes well above any that were previously attainable. It may rank with the development of heavy bombers among major American contributions to the aeronautical technology of this war."

The article then goes on to deal with such practical considerations as the problems of getting the aircraft into service, of fitting different types of equipment together, and of providing all the information and auxiliary supplies necessary for efficient use. Fortunately, most of these incidental troubles, which were apparent six months ago, have now either been entirely overcome or are well on the way to disappearance. There had been differences between British and American designs for auxiliary equipment. For example, changes in gun installation had been known to involve changes in firing control running all the way to the pilot's cockpit. Another example was a necessary change in radio and other electrical equipment which called for a change in the characteristics of the engine-driven generator. That, in its turn, had been found to modify the engine's vibration characteristics, and it was only after a period of very urgent shop and laboratory work that means of overcoming the resultant mechanical difficulties were found and applied.

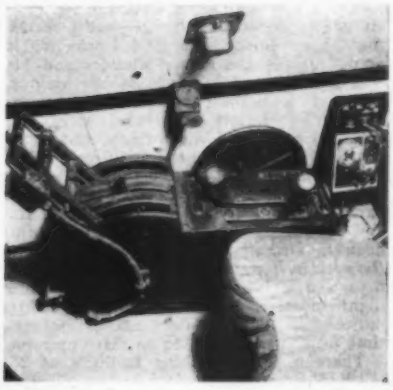
There were also a number of trivial details, such as the difference between the British and American standard practice in the folding of maps for ready reference, which made the map-cases of one country inconvenient for the maps of the other.

"Such problems," Mr. Warner points out, "are inherently those of the early stages of association."

BRITISH OVERSEAS AIRWAYS BOEING 314A

Mr. Churchill's Flight Brings Boeing Flying Boats into Prominence

AS long ago as March, 1939, *Yankee Clipper*, the first of the Boeing 314 flying boats, flew the Atlantic in the hands of a Pan American Airways' crew. Because of the Royal Air Force expansion, we were unable at that time to build boats of our own, so three Boeings of a slightly modified type were ordered for British Overseas Airways. These were delivered about the middle of last year and have been employed on the Atlantic service ever since. The major differences between the original 314 (described in *Flight*, April 13th, 1939) and the 314A as now operating are: All-up weight, 88,000 lb., an increase of 5,500 lb.; 1,650 h.p. Double-row Wright Cyclones in place of the original 1,500 h.p. models, and the hull step has been moved backwards to reduce porpoising. Disposable load amounts to 32,450 lb., and there is accommodation in comfort for 66 persons, including the crew of eleven. The number of crew remains constant, but passenger capacity varies according to the length of the non-stop run to be flown. From Lisbon to Foynes over 40 can be carried, whereas on an Atlantic run only nine persons can be accommodated.



(Top) The front view of the 314A showing its clean lines. Drogues suspended from the wings stop violent swaying at its moorings. (Centre right) Only master throttle controls are provided in the pilots' cockpit. All the subsidiary controls are in the care of the flight engineer. (Centre left) Looking through the Commander's side window the two engines obscure the wing tip. The circular device held by three elastics is an intercom microphone. (Below left) Flight engineer at the control panel. The doorway in the background leads into the wing and engine nacelles. (Right) Using the intercom telephone in the mooring compartment in the bow. (Bottom) *Bristol* in war paint. The other two ships are named *Berwick* and *Bangor*.

THE CRUISE of the BERWICK

Bermuda to Plymouth Within One Minute of Schedule : Capt. Kelly Rogers' Report on Historic Flight

AFTER the flight of 3,365 miles across the Atlantic, the British Airways' flying-boat *Berwick*, which bore the Prime Minister and his party on their journey home from the United States, touched-down at Plymouth within one minute of its estimated time of arrival.

This is revealed in the report on the flight which the Commander of the aircraft, Captain J. C. Kelly Rogers, has made to the British Overseas Airways Corporation.

Late in the afternoon of Monday, January 12, I received an urgent summons to the Air Attaché's office at the British Embassy in Washington, says the report. There was such an air of suppressed excitement that I realised the flight was of the highest importance, and I was told that the passengers would include the Prime Minister and his associates.

A special train was to leave Washington the evening before the flight with the passengers and baggage, and would arrive at Norfolk, Virginia, at about 04.30 in the morning. The crew and I slept aboard the aircraft and rose about 4 a.m. We obtained little sleep as it was bitterly cold.

The train arrived on schedule and was shunted into a siding at the airport, where the baggage was unloaded while the party slept on. Some of our staff had travelled on the train, and the baggage was swiftly transferred from train to dock and dock to aircraft. All baggage and freight was aboard the *Berwick* by 6 a.m., and the passengers started to arrive about 6.30 a.m. I had previously been ashore and obtained the flight forecast, together with final instructions. The plan indicated a flight to Bermuda of four hours, and the actual time on course proved to be three minutes less than that.

There were no docking facilities at Norfolk, nor could a tail line be provided, so we had to rely on the engines starting immediately from cold. It was a very cold morning and nearly calm, so I slipped the buoy before attempting to start the engines. A launch was standing by in case of emergency, but its use was not necessary, as the engines started up in record time and in eight minutes we were airborne.

The morning was a typical winter's one—cloudless with a light surface haze—and the take-off was normal in every respect. All passengers were seated and properly distributed throughout the aircraft so as to give a reasonable centre of gravity position.

Capt. Kelly Rogers then goes on to describe how, after Mr. Churchill had breakfasted in his private suite aft, he showed him over the *Berwick* and introduced him to the crew.

Mr. Churchill Takes Over

The Prime Minister's questions concerning the operation of the controls and general behaviour of the aircraft, the report continues, made it quite clear that he would like to handle her himself. I invited him to do so and he responded immediately. I disengaged the automatic pilot and whispered an instruction in Captain Shakespeare's ear, who was on watch at the time in the co-pilot's seat, to apply only such corrections to the controls as would be necessary if the aircraft got beyond the Prime Minister's control. No major correction was necessary. In fact, the Prime Minister asked if he could make a couple of slightly banked turns, which he did with considerable success; he was at the controls about 20 minutes altogether and afterwards commented upon the difference between this aircraft and the one he had flown as long ago as 1913.

I would like to say here that at all times the crew responded wonderfully to the calls made upon them, which were many and exacting. They were conscious throughout of the great responsibility placed upon them and the honour involved in being invited to assume it.

On the morning of departure I went over to the Meteorological Office in company with Captain Loraine and First Officer Buck, the navigator. Before doing so I had checked with the engineers the amounts of fuel and oil required.

Our departure was without incident; the aircraft became airborne in less than a minute. Conditions indicated a fast flight. A very careful analysis of the weather forecast was made, in order to produce a flight plan, and our ability to reach suitable alternative alighting areas was carefully worked out. If in the course of the flight the weather conditions were likely to be different from those anticipated, it is possible for the control stations to supply the aircraft with amendments to the forecast already in its possession. As it turned out, the forecast proved to be extremely accurate and no amendments were necessary. The accuracy of the forecast was so striking that I caused a signal to be sent to Dr. Macky, at Bermuda, congratulating him on his success.

I invited Sir Charles Portal on the control deck for the take-off and he was impressed by the performance of the aircraft, particularly as the density altitude on the surface at the time of departure was 1,600 ft. We climbed rapidly to our cruising altitude and settled down there.

It was possible to do the whole flight under standard cruising conditions because of the extra fuel carried and the favourable flight forecast. This was of great advantage because in addition to providing a higher air speed, it resulted in the aircraft adopting a more comfortable attitude in the air, and both results combined to make her more stable for flight through the four cold fronts which the flight forecast showed had to be negotiated.

Accurate Navigation

As the flight progressed it was obvious that we were travelling very fast, but it was only possible to take single sun position lines until the arrival of darkness. These position lines established at least that we were adhering closely to our track, but when, shortly after dark, a star fix was obtained we found ourselves to be 90 miles ahead of the flight plan. This gave a speed of 199 m.p.h. from the start and 207 m.p.h. during the previous hour. The actual distance covered proved to be 2,924 nautical miles or 3,365 statute miles.

Except when flying through the cold fronts, we mostly flew between two layers of cloud, which made the obtaining of astronomical fixes difficult, and the greatest credit, therefore, is due to the navigator, First Officer Buck, for the wonderful accuracy which he displayed. Icing conditions were experienced at all times when in cloud or rain, but caused us no embarrassment. As soon as the outside air temperature indicated the possibility of such conditions the carburettors were put on hot air and functioned like that for most of the remainder of the flight.

It is worth recording here that the engines ran beautifully throughout and never gave us a moment's worry. The ice which formed on the loading edges of the wings was easily disposed of from time to time by operating the de-icer boots.

During the evening the Prime Minister and Lord Beaverbrook again visited the control deck. The aircraft was riding through a brilliantly star-lit sky, with the outline of the cloud tops just visible below, and both the Prime Minister and Lord Beaverbrook surprised me by saying that they envied me my job.

All passengers had gone to bed during the night, excepting Lord Beaverbrook, who sat up reading the whole time. Just after witnessing the dawn the Prime Minister went below and joined the other passengers in a light breakfast preparatory to returning to the control deck to witness our landfall on the English coast. He had taken all his meals with the other passengers on this flight.

Fog Encountered

No radio bearings had been asked for or received throughout the whole of the flight until fog was encountered, but in order to make absolutely certain whether we were north or south of our track we requested a bearing, which we received, confirming our view that we were slightly south, so we reset our course. By this time the Prime Minister was seated in the co-pilot's seat, Lord Beaverbrook standing behind him. All that was visible was a rolling expanse of fog, and they could not, therefore, appreciate the fact that we were following a definite plan of action, which was apparent to us by the radio bearings, but remained hidden from them. The conditions actually encountered caused me no concern whatever. Before we landed, the Prime Minister vacated the co-pilot's seat, which was then occupied by Captain Shakespeare, who was acting as Chief Officer. A mooring was ready for us, launches were standing by, a guard of honour mounted on the breakwater.

We had been in the air for 17 hours 55 minutes. Our estimated time of arrival, as worked out before leaving Bermuda, was fixed at 09.00 hours Greenwich mean time. We touched down at 08.59 hours.

HERE AND THERE

Racing Helps R.A.F.

THE R.A.F. Benevolent Fund has benefited to the extent of £5,489 as the result of Lord Sefton's appeal for a special contribution from those interested in racing, published in *The Times* last September.

This handsome sum represents the whole amount raised, nothing having been deducted for expenses, and the special appeal is now closed.

To Discuss Air Training

AIR VICE-MARSHAL ROBERT LECKIE, who won the D.S.O., D.S.C. and D.F.C. whilst serving with the R.N.A.S. in the last war, and who is now Canada's air training chief and a member of the Canadian Air Council, has arrived in this country to confer with the Air Ministry and staff of the R.C.A.F. in Britain on various matters concerning the Dominion's part in the Empire Air Training Scheme.

Before he went to Canada, A.V.-M. Leckie was A.O.C., R.A.F., Mediterranean, with headquarters in Malta.

Experts Disagree

MR. HUDSON FYSH, managing director of Qantas Empire Airways, Australia, recently stated (as recorded in *Flight* of January 15th) that Germany's latest four-engined bomber, the He 177, had been estimated to be capable of reaching New York, from Brest, with a 1,000 lb. bomb load, and of making the return trip afterwards—its range at 180 m.p.h. with such a light bomb load was quoted as being 7,040 miles and the return trip would only total 6,640 miles.

Admiral J. H. Towers, chief of the U.S. Navy's Bureau of Aeronautics, however, was recently reported in the *Daily Telegraph* to have expressed the opinion that the only possibility of an air attack on America's east coast was a "stunt attack" from which the raiders would *not* be able to get back.

Incidentally, when the long-range Wellesleys made their record flight of 7,162 miles from Egypt to Australia in November, 1938, *Flight* pointed out that it was approximately equal to a return trip between Europe and America and reminded its readers that the record flight of to-day has a habit of becoming the commonplace flight of to-morrow.

PARATROOP FANCIER: In the cylindrical container at his waist this paratroop carries a homing pigeon.

RED STAR TURN: This view of the P.E.2 shows the careful streamlining of the liquid-cooled engine. In operational use it is the Russian equivalent of the Junkers Ju 88. The airscrew hubs are fitted with claws for positive starting in cold weather.

Portable Steel Runways

IN this war of rapid movement the ability to prepare a temporary airfield in minimum time is patently of immense strategic value.

United States Corps of Engineers have recently been experimenting with "portable airfields" (more accurately, portable runways), consisting of corrugated steel gratings 10ft. long, 16in. wide, and ¼in. in thickness. These strips are locked together to form a runway 3,000ft. long and 150ft. wide (a photograph appeared in *Flight* of January 1st), and they have the added advantage in wartime of being easily camouflaged.

Successful Tests

THEY were used in the Louisiana and South Carolina manœuvres just before the Japs launched their attack, and are reported in *Aero Digest* to have been completely successful. The fastest and largest of aircraft were able to take off and land without difficulty, and the portable runways were found to be of particular value on sandy soil and other soft surfaces.

Bulldozers were used to level off all hummocks and bumps before the steel runways were laid, and the army engineers found that the best and quickest way to deal with grass tufts was to cut vents in the thin steel strips. A complete runway weighs some 1,000 tons, and this, together with the necessary accessory equipment, was transported in 15 to 20 freight cars.

Wire-netting Roads

PLANNED and built at Fort Belvoir, Virginia, the runways were first tested and developed by the 21st Corps of Engineers at Langley Field.

We are reminded by them of the temporary tracks for light motor traffic which were laid over the desert sands in the East during the last war. These consisted of ordinary wire-netting, and were just sufficient to prevent the wheels of motor cycles and light cars from sinking into the sand. Heavy lorries were not allowed to use them, but even so their durability was not too satisfactory.

Canadian Co-operation

GRANT McCONACHIE, of Edmonton, president of Yukon Southern Air Transport, said in an interview at Edmonton, Alberta, that the chain of airports under construction across Northwestern Canada now are in "good enough shape" to handle any traffic of U.S. Army planes flying to Alaska. He was recently appointed as an assistant to W. M. Neal, vice-president of the Canadian Pacific Railway in charge of Western air lines, and will be in charge of air transportation for the C.P.R.

"We are prepared to give every service to U.S. bombers and other patrol aircraft going to Alaska and the Aleutian Islands," the air executive said. "We are ready to give the assistance of our radio and navigation aids for U.S. ships and, if necessary, we will triple or quadruple our staff to give them 24-hour-a-day service until the Department of Transport gets its service in full operation."

HERE AND THERE

Queen's Cheque for R.A.F.

HER MAJESTY THE QUEEN has just sent a cheque for £200 to the R.A.F. Benevolent Fund, representing the R.A.F.'s share of gifts of money from people in the United States and Canada.

These generous gifts had been sent to the Queen during recent months with the request that "they be spent on purposes connected with the war, according to Her Majesty's pleasure."

Mistakes 1d. Each

A MONEY-BOX stands between the neat rows of different coloured telephones, microphones and loudspeakers on the Controller's table in a Coastal Command operations room in the north of England.

Unlike most charity collecting boxes—which often remain in forgotten corners until they are frantically circulated the day before they are due to be "called for"—this money-box has a steady if slow income.

It was instituted by the Station Commander, a Group Captain, to keep his staff on their toes. Whenever he finds the slightest error in the multifarious data of the operations room—in goes a penny from the controller who is responsible for the information displayed.

So far, in a year or so of working, it has been cleared four times.

The proceeds? They provide chewing gum for the air crews.

W.A.A.F. Strength Doubled

WHEN 1942 began, the W.A.A.F. was the largest women's service and had a strength exceeding that of the entire R.A.F. at home and overseas shortly before the war—several times the number enrolled in the last war in the W.R.A.F., the predecessor of the W.A.A.F., which was founded in June, 1939, by Royal Warrant.

BEFORE: A Mitsubishi twin-engined bomber being bombed-up with missiles uncommonly similar in shape to those used by the other end of the Axis.

Every airwoman is a volunteer; and it is an indication of the appeal which the women's Air Service has made that although the programme called for doubling the strength during the last four months of 1941 the numbers were obtained with ease.

R.A.F. Sea Harvest

THE enterprise of a few R.A.F. officers has provided nearly a quarter of a million fish meals for airmen during the past four months. Three tons a week are delivered to R.A.F. stations in London. Yesterday's catch arrives for this morning's breakfast—with good luck. A fleet of seven boats employs 54 civilian fishermen, some of them invalided out of the Services during the present war.

During the last four months of 1941 the total catch was 121,240lb., which was disposed of to R.A.F. messes. Valued at the rate of about a shilling a pound, it was worth £6,062. Allowing half a pound per man this is the equivalent of 242,480 fish meals.

Most of the fishing is done with long lines baited at intervals, but when weather permits some of the boats trawl. One boat was shot up by a Nazi raider not long ago, but reached port afloat. Numbers of lobster pots are set in season and neither lobster nor crab is a stranger in any of the R.A.F. messes supplied.

AFTER: The remains of a twin-engined Mitsubishi bomber being hauled out of Pearl Harbour.

R.A.A.F. Recruiting

SINCE the outbreak of war a total of 205,347 recruits has applied to join the Royal Australian Air Force, according to *The Air Log*, a Sydney publication.

Of these, 44,630 applied for flying duties in air crews and 160,717 submitted applications as ground staff, but more recruits with the right qualifications are needed to maintain the flow of trained airmen from the Empire Air Training Scheme there. There is also an urgent need for more technicians.

The Women's Auxiliary Australian Air Force has attracted nearly 6,000 applicants, more than half of whom have been enrolled and the remainder placed on the waiting list.

Cellon Limited Appointment

MR. N. F. ROSE, M.B.E., has been appointed a Member of the Board of Cellon Limited.

Mr. Rose joined the Company on the 1st September, 1926, to represent them in Birmingham and district. In June, 1928, he was appointed Midland Area Manager, and still holds that position.

Twenty-fourth of the Second Series

FRIEND or FOE?

British and German Floatplanes: Blackburn Roc and Arado Ar 196

ROC : Fin and rudder set well forward of tail-plane ; Additional fin area below tail of fuse-lage. Tapered tailplane with rounded tips.

ALTHOUGH the Blackburn Roc is generally bracketed with its sister craft, the Skua, as primarily a land machine operated by the Fleet Air Arm from aircraft carriers, it is also used as a floatplane, in which guise it bears quite a strong resemblance to the Arado Ar 196.

We are mainly concerned, in this series, with tail assemblies, and though it is by their tail units that the Roc and the Ar 196 can be most readily differentiated from a rear view, no reference to the former on the score of identification can well be made without mention of what is really its most outstanding feature—namely, the power-operated gun-turret. The Roc, of course, shares with the Defiant the distinction of being the only two single-engined, two-seater fighters in the British list so to be equipped, and the turret can generally be seen from almost any angle except from directly beneath.

Few aircraft have a more distinctive tail arrangement than the Roc (and, of course, the Skua), and, if it can hardly be handed the palm for sheer beauty of line, it certainly simplifies the all-important task of the spotter. This is because the vertical surfaces are mounted exceptionally far forward in relation to the tailplane, as will be seen from the accompanying illustrations.

The fin and rudder, which are of comparatively high aspect-ratio, have a convexly curving leading-edge and a small, rounded apex which drops down into an almost straight, vertical trailing-edge. The rudder takes up the greater portion of the vertical area, the rudder post actually being forward of the leading-edge of the tailplane, and the heel of the trailing-edge well clear of the elevators. There is also a most unusual stabilising fin below the tail end of the fuselage so that, altogether, the side elevation of the assembly looks distinctly curious.

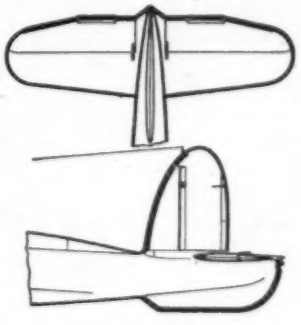
In plan the tailplane is of fairly high aspect-ratio and has a slight back-sweep on its leading-edge, and round tips. The trailing-edge, however, has a break at about the semi-span where it suddenly begins to taper rather sharply towards the tip, while the centre section (inboard of the elevators) shoots out to an abrupt point.

By contrast, the Ar 196 tail-unit is quite a graceful affair. Its tail fin and rudder have a straight, backswept leading-edge rising to a neatly rounded apex from which the trailing-edge sweeps easily out and down in a well-proportioned convex curve, the heel of the rudder curving in to the foot of the rudder-post at the base of the fin and above the elevator. The tail plane is of low aspect-ratio and has a pronounced backsweep to its leading-edge, round tips and a straight trailing-edge, the elevator being a single panel stretching across the entire span and projecting clear of the fuselage extremity.

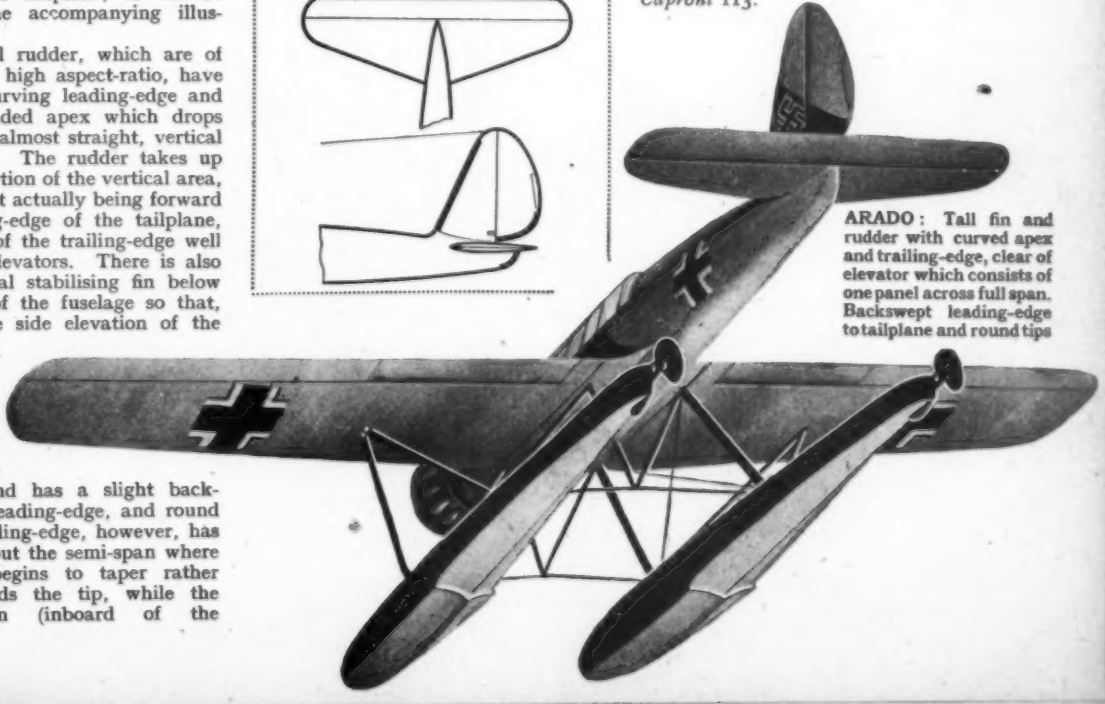
Details of the Ar 196 have only recently been released, but it is now known that the armament includes a cannon and machine guns.

Next week: Bristol Bombay and Caproni 113.

ROC SEAPLANE



AR 196



ARADO : Tall fin and rudder with curved apex and trailing-edge, clear of elevator which consists of one panel across full span. Backswept leading-edge to tailplane and round tips

(1) After flight-testing their Whitley, a can of beer in the Mess.
(2) The wireless operator/air gunner is somewhat of a Cinquevalli.

AIRCREW'S DAY

Round the Clock with a Whitley Crew who are all N.C.O.s

MANY of the bombers which make their nightly trips to Berlin, Brest, or any other target which may be on the agenda, are composed entirely of non-commissioned personnel. Usually they are all sergeants with the exception of the captain, or first pilot of the aircraft, who is frequently either a flight sergeant or warrant officer. In these pictures is shown the normal routine followed during 24 hours by a sergeant's bomber crew who fly an Armstrong-Whitworth Whitley of Bomber Command.

The navigator and wireless operator, upon whom the safety of both aircraft and crew so much depend, have each done over 30 operational trips, and both have also been awarded the Distinguished Flying Medal. While, of course, all the credit for the actual operational flights must go to the air crews, the ground staff who repair and maintain the aircraft must not be forgotten. Theirs is often unpleasant work carried out under conditions of extreme difficulty, especially during the winter.

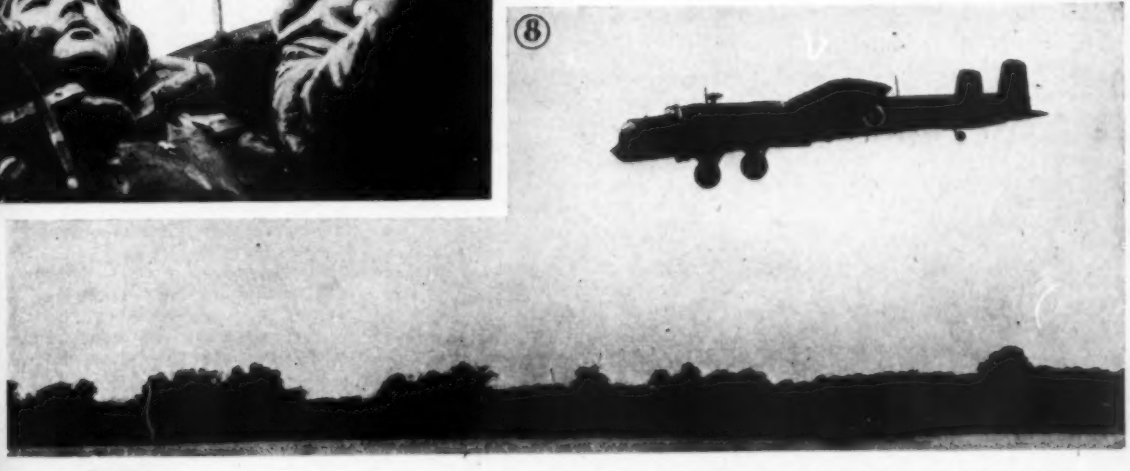
(3) A game of bridge while the first pilot looks on.
(4) In the locker room, putting on their leather Irvinsuits and flying boots.

(5) Off to Station H.Q. for "briefing." It will be noticed that two wear pilots' wings, two wear air gunners' single wings and one an observer's single wing.

(6) With all the paraphernalia ready for the flight, Mae Wests and Harnisuits are donned.

(7) At the controls. The captain and second pilot in the Whitley.

(8) By the early dawn light the Whitley returns from its mission many thousands of pounds lighter than when it took off.



(9) With parachute packs, navigation instruments and thermos flasks in hand, they dismount and make their way back to the locker room.

(10) A well-earned breakfast completes a day when most people are just starting out.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Yellow Locusts

TWELVE thousand Japanese have volunteered for training with the Japanese Parachute Corps. Centres of training have been established on the aerodromes of Nagasaki, Kobe, Seul and Tsuruga.

The Paper Drop

A PARACHUTE made of paper has been developed by the paper industry of Saitama (Japan). This parachute is designed only as safety equipment for pilots and not for dropping loads. The Japanese claim that this new product is equal in quality and resistance to the standard silk parachute and even less susceptible to sudden changes of temperature.

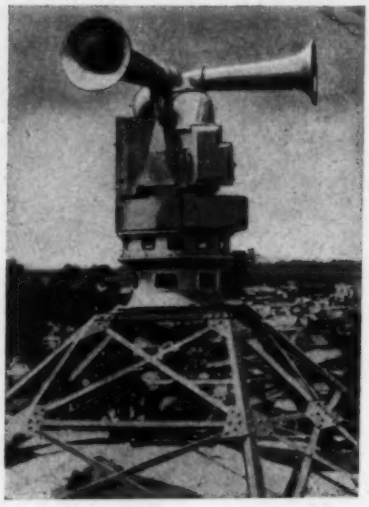
Whale Oil for Aircraft Engines

DR. SEIICHI ISHISEWA, of the Tokyo Academy of Literature and Science, has developed a new lubricant for aircraft engines from whale oil. A company subsidised by the Japanese Ministry of Commerce and Industry is to take up the large-scale production of the new product to meet urgent requirements.

Shortage of Technicians

ALTHOUGH the Germans boast of their inexhaustible resources of skilled labour, there is evidence of the growing shortage of technicians. Even Government institutions and large firms cannot procure highly skilled men through the ordinary channels. Thus the Bücker Aircraft Co. (makers of the Bücker Bestmann described in *Flight* of January 15th, 1942) are looking for engineers for their development department.

The University of Leipzig wants a works manager with experience in glider construction; a firm of instrument makers is trying to find mechanical engineers, even without previous experience, for their design and development branch. Works managers and test pilots are particularly sought after and are being promised permanent jobs. Draughtsmen, even without aircraft experience, are lured by possibilities of advancement to designer rank.



TOKYO ALARM SIGNAL: An elaborate syren which is one of a standard type employed in the Japanese capital. It is to be hoped that the American pilots will soon start them up.

Schoolboys for Factories

GERMAN boys from secondary schools are encouraged to spend their holidays in the apprentice workshops of the large aircraft factories. Since the boys are not only receiving tuition, but are also employed on various semi-skilled jobs, this seasonal employment helps, no doubt, to fill in the gaps in the Nazi man-power resources.

Compulsory Gliding

GLIDING has been declared a compulsory subject for all students (male and female) of the Physical Culture Faculties of German Universities. Special camps distributed all over Germany have been established for this purpose, and students have to participate in courses covering the theoretical study of gliding as well as its practical application.

A Formidable Gun Carrier

AIRDROME defence is very much in the public eye just now in this country. Nor is the enemy inactive in regard to this all-important matter, and has developed a new heavy type of transport vehicle mounting four quick-firing cannon. Hitherto six-wheeled vehicles have been used, but the new type has a semi-creeper track, the front wheels steering only. It accommodates eight men.

This go-anywhere type of vehicle, with its multiple quick-firing guns, is designed to traverse soft or "impracticable" ground, and provide a means of approaching airfields over ditches, if necessary. Another point stressed in the German claims is that these guns may be used against ground objectives as well as providing a means of defence from air attack. In Russia such vehicles have also been used to attack strongly fortified Soviet points.

FLAK WAGON: The German dual-purpose gun carrier which is described on this page. It is eminently suitable for the defence of airfields.

Factory Workers in Germany

A BELGIAN engineer recently arrived in this country had the interesting experience of working, together with other Belgians and Frenchmen, in German aircraft factories.

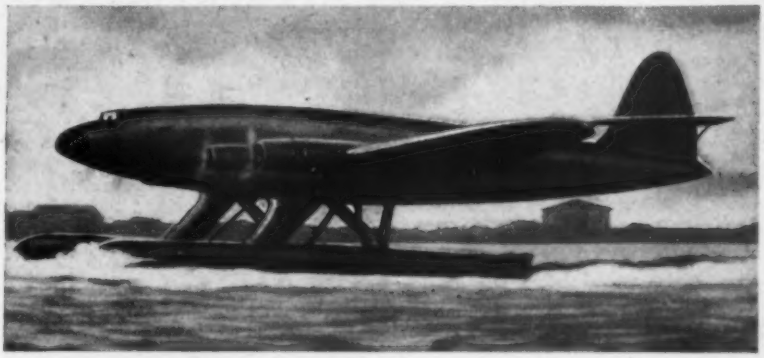
Here are a few interesting comments on the conditions prevailing in some of those factories. Workers are well paid but work long hours and their diet is generally poor. French and Belgian skilled workers received the same rate of pay as the Germans and had complete freedom of movement.

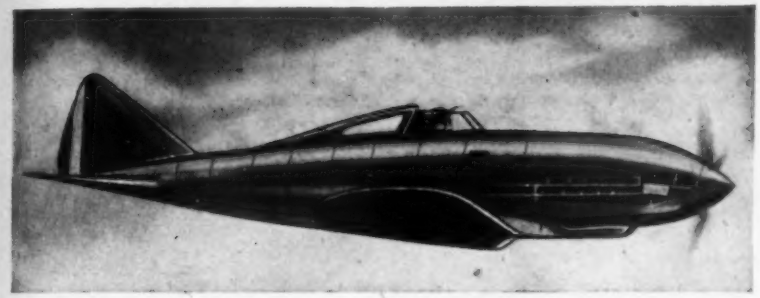
In Berlin aircraft factories, old

BEHIND THE LINES (CONTINUED)

workers, who still remember the pre-Nazi days and the last war, are completely segregated from the young ones, for fear of undermining their Nazi morale. Separate shops with separate controlling personnel exist for this purpose.

When asked whether there was any anti-Nazi activity sponsored by the foreign workers, the Belgian answered that that was not necessary, for it was the German worker, the old-timer, who encouraged the Belgians and Frenchmen to return to their countries and to engage in anti-Nazi activity, which is "easier in occupied Europe than in Germany proper."





(Above) Cant-Z 511, a new Italian trans-ocean aircraft. No mention is made of the oceans for which the plane was designed. Powered with four 1,350 h.p. Piaggio P12.

(Left) An Italian single-seater fighter, Reggiane Re 2001.

Technical Auxiliary

TO relieve the regular ground personnel of the *Luftwaffe* of various duties connected with the maintenance of landing fields, the *Technische Nothilfe* (Technical Auxiliary) has been for some time in existence. The Corps is composed mainly of artisans of over 40 years and is a part of the *Luftwaffe*. Their duties cover such wide range of activities as construction and maintenance of landing fields, hangars, and signalling installations.

Identification

LUFTWAFFE pilots and navigators operating against Allied shipping are given a special course of instruction in identification of various types of Allied vessels. Plastic models of ships and harbour installations are used for this purpose. Electrically operated models of British and Allied naval units are placed in a specially designed glazed box into which smoke is introduced so that identification can be practised under adverse conditions.

The Co-prosperity

SURVEYS in selected regions of Japan made by the Sanitary Bureau have revealed that out of 130,000 persons examined only 10 per cent. were free from disease, 73 per cent. were afflicted with parasites, 15 per cent. with trachoma and 6 per cent. with other eye diseases.

An official source recorded an increase within the last 20 years from 270 to the present average of 450 per 1,000 in rejections of conscripts on medical grounds.

THE ELECTRIC WHEEL

THE importance of psychological selection of flying personnel cannot be underestimated. Modern aircraft performance demands from the pilot a high degree of intelligence, alertness and an ability to react and act quickly in any position he may find himself. Experiments have shown that it is not always the young pilot who displays these psychological qualities. Indeed, the reactions of a mature man with considerable flying experience are frequently better than those of a young, uninitiated novice. The capacity to control nervous reactions, fatigue, apathy, coupled with a better power of concentration, do not always go together with mere physical robustness. Since the value of positive reactions is of immense importance to the making of a good pilot, various psycho-technic tests and appliances are in use to ascertain their existence.

Such an appliance is the electrically operated wheel used by the *Luftwaffe* and shown in this picture. The purpose of this wheel is to study the change of psychic reactions under different body positions and under the influence of rapid rotation. Candidates for air crew duties are strapped to the wheel in a lying position and are given a pair of earphones. While the wheel is rotating at various speeds and in a changeable rhythm, the strapped candidate is called upon to answer simple mathematical questions. These answers are checked up for their correctness and speed. Results of such experiments have to fit in with the mosaic of such psychological information as has been obtained about the prospective flier.

The Psycho-Technic Institute of Charlottenburg Technical College, which is in charge of these investigations, has worked out an average standard of reactions which form a minimum standard for *Luftwaffe* candidates.

Topics of the Day

STALLABILITY

Do Landing Speeds Matter? : Strange Effects of High Wing-loadings : Increasing Lift at Low Speeds

IF there is one thing that the average stooge pilot of pre-war days has learnt during his or her wartime excursions, it is that high stalling speeds make little or no difference to the actual difficulty or otherwise of learning to fly. The idea that it is intrinsically more difficult to land an aircraft at 70 m.p.h. than at 35-40 m.p.h. was commonly held at one time; in fact, once flying and the essentially more difficult business of approach judgment have been mastered, the faster the landing speed the easier everything is—because the machine is so much less affected by odd variations in atmospheric structure and, once down, tends to remain where it is—at least in the up and down plane.

Floatability

Needless to say, it is originally necessary to learn to fly on slow types because the novice—and the instructor—need so much more time and space for their respective struggles.

"Floatability" is a very great asset in trainers because it gives both the teacher and the taught time to discuss things in comparative leisure and safety, while sheer slowness allows a vast margin of error during the approach, and so saves training time. If the pupil were put straight into something of the Master calibre, he would not only have to cope with a lot of devices, but would also be allowed about one landing attempt in three, and the time wasted would be tremendous, but he might, once he had recovered from the shock of sheer power and size, find the outfit very much more easy to put down than a Tiger Moth.

I have never been one of the "we must land slowly" maniacs. Even in light aircraft days I always hated the affair which was still ballooning about in the air at 35 m.p.h. or less. Even on calm days the thing was something of a menace, and on gusty days, of course, it was almost uncontrollable near the deck. I preferred the machine which stalled quite firmly and finally at a speed in the region of 50 m.p.h.—high enough to make the aircraft a practical proposition on windy days and to prevent it from trailing wing tips and things if everything didn't go entirely according to plan.

Tricycle Stalling

Now I should prefer the figure to be 60 m.p.h.—with a tricycle undercarriage and/or enough drag to bring the speed down rapidly after landing in comparatively small spaces. Unless and until somebody invents a fully variable wing—so that a Jekyll and Hyde machine is a practical affair—the "aircraft for all," which can be flown from the backyard, is not very likely, though a good deal may still be done with the auto-rotating wing provided the blades can be so controlled that, at a critical second before touching, every atom of excess lift can be entirely removed. But that is where the tricycle comes in with more rational types; as soon as the main wheels have hit the ground the whole thing tips on to the nose wheel and remains forcibly down in an attitude at which the stalling speed is higher than anything likely to be encountered in gusty conditions. So a very slow-landing device *might* be a practical possibility if it were fitted with this type of undercarriage and if it were otherwise so efficient that it would cruise at a useful speed and not sit about in the sky going nowhere whenever the wind was blowing at more than a mild breeze. I remember setting off in a Drone, or some similar machine, to go to an airfield which was only about 30 miles away. Unfortunately, the airfield in question was directly up-wind, and after remaining pointed in the right direction, but with the place of departure still in view below the centre-section, I gave it up.

After this war, in which most of us have been flying aircraft with a cruising speed of 200 m.p.h. or more, we shall be very impatient indeed if we have to loiter around making a ground speed of 50 m.p.h. or less. I think we shall prefer to take the minor risk of engine failure and forced-landing crack-ups to the pain and anguish of travelling at the speed of a motor car. Engines very rarely pack up completely and suddenly, and there will be a host of airfields at our disposal until the runways crack after successive years of frost and lack of attention. Some of these airfields are not in very useful places, but they will be good enough for forced landings due to weather or to any other cause.

Of course, there is a reasonable limit to rational wing-loadings, especially where small aircraft are concerned, and this will be so until some bright person devises a new and ingenious series of wing sections to suit such loadings. Everything seems to be all right until figures higher than 40 lb./sq. ft. are reached; above that figure some very queer things begin to happen. So far, stalling characteristics are not showing signs of becoming more dangerous, but most of the machines with very high wing-loadings appear to start an initial stall at speeds some 50 m.p.h. higher than the actual stall as written in the book of words.

Underpowered Hens

That is possibly a characteristic of certain wing sections only, but I have noticed it on two entirely different types. The curiosity is so marked in one of the types that it is possible to lose several hundred feet during a final circuit and while fiddling about inside with undercarriage controls and sundry other little matters. If, due to poor visibility or other causes, this circuit is being made at 500 feet, the newcomer, after reducing speed and lowering the undercarriage, may look out to find trees going past the windows. Needless to say, it is possible to stop the sink by hoisting the aircraft on its tailplane and flying around with the outfit looking rather like an underpowered hen; but the attitude feels all wrong and therefore, I think, is all wrong. The ideal cure is to lower the flaps by an amount sufficient to increase the lift and to supply enough drag to make the attitude more normal. In fact, I think that the lowering of flaps, almost before the undercarriage, for the whole of the final circuit is a good thing. Control is greatly improved and the aircraft feels much more normal at comparatively low speeds.

If we are to think in terms of phenomenal loadings it will be necessary to develop still further the type of flap which really increases lift to a very marked extent. I have never felt that sufficient energy has been devoted to the development of such extra-lift devices. Most people will remember that on the first type to be fitted with the Fowler flap—the Lockheed 14, now the Hudson—most of the high-lift advantages were lost because the slipstream and/or the airflow bounced off the ground on to the tailplane when the flaps were lowered and they could not, therefore, be successfully used to shorten the take-off run.

Bounce Effect

In fact, there was, at one time, a tendency to use comparatively little flap on this type, even for landing, because, I believe, the "bounce" effect of the air trapped under the large flap area made landing more difficult. Pilots would rather use more field than to use full flap and risk a "short one" which might not come off properly—and a bad landing with this type certainly resulted in the most extraordinary series of leaps and bounds. I have no knowledge of the technique employed by real Hudson pilots—I am merely talking from the small personal experience gathered while ferrying the type, light, from place to place.

I repeat—with higher wing-loadings people will really have to get down to the development of useful lift-increasing devices, war or no war and tricycles or no tricycles.

INDICATOR.

A.O.C.-in-C.'s INSPECTION

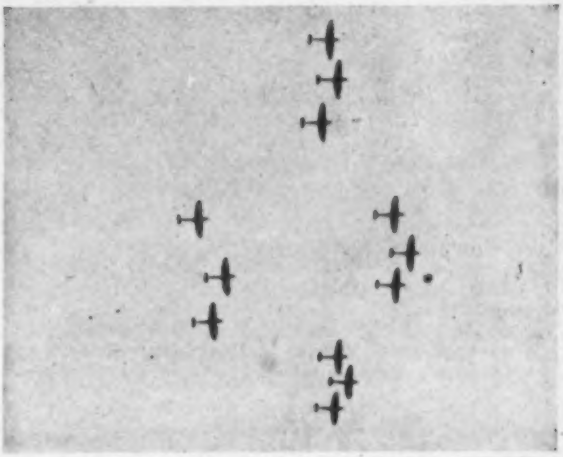
Spitfire Operational Training Unit on Parade for Fighter Command Chief

ON this page are a series of photographs obtained during a visit by Air Marshal Sir W. Sholto Douglas, K.C.B., M.C., D.F.C., to inspect a Spitfire-equipped operational training unit. This unit is employed in giving the final touches of training to pilots who will be posted to squadrons operating under Fighter Command.

A number of the pilots received their initial training under the Empire Training Scheme and, as will be seen from the squadron formation, the standard of flying is very high.

In the pictures below, Air Marshal Douglas is seen watching the flying with Air Comdre. J. A. Vincent, the Station Commander, on his right, and, at the bottom of the page, inspecting N.C.O. mechanics and watching armourers at work rearming the machine guns in the wing of a Spitfire.

The other photographs show the pilots running to their machines and emplaning on the sounding of the alarm, and coming in to land with wheels and flaps down at the conclusion of the flying programme.



WAS THIS THE FIRST?

An American Patent of 1929 for an Asymmetrical Aircraft : Germany Anticipated by—Theodore P. Wright

WE will begin these notes by supplying our own answer to the query in the heading. The first lop-sided aircraft was also the first practical aircraft: the Wright brothers' biplane of 1903, which had the engine on one side and the pilot on the other. That was quite a few years before Cy. Caldwell thought of his wisecrack about "built-in headwinds." Thus the Wright biplane was asymmetrical when empty, although not in quite the same way as the different types referred to in *Flight* during July and August of last year when, it may be recalled, we began the discussion with a suggestion from an officer of the R.A.F., and followed it up with extracts from German patents granted to the Hamburger Flugzeugbau.

Priority

The date of application of the German patent was December, 1937. The well-known American aeronautical engineer, Theodore P. Wright, engineering chief of the Curtiss-Wright Corporation and at present assistant chief of the aircraft branch of the American Office of Production Management, has written to us about our so-called "Loppy" aircraft correspondence, and sends a photostat copy of an American patent granted to him. The patent is dated February 7th, 1933 (No. 1,896,270), but the application was filed on September 6th, 1929. In the patent Mr. Wright is described as "Assignor to Curtiss Aeroplane & Motor Company, Inc., a Corporation of New York." That was before the amalgamation of the Curtiss and Wright concerns.

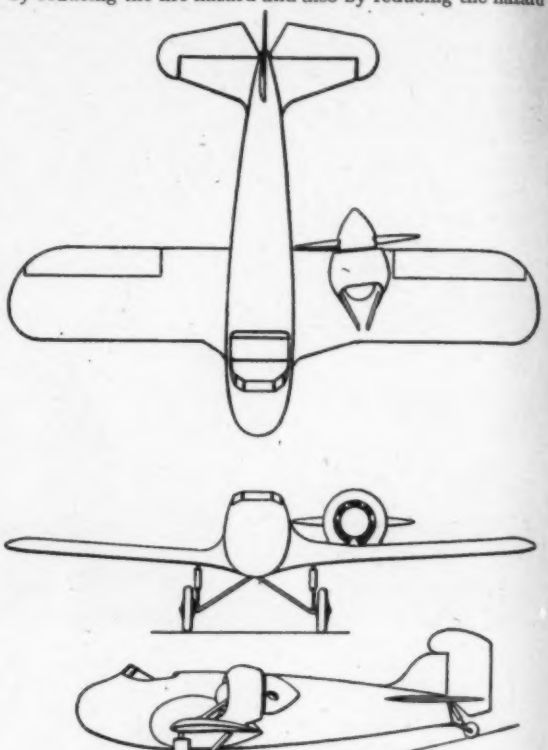
From the three-view general arrangement drawings it will be seen that Mr. Theodore P. Wright's scheme related to a single-engined pusher aircraft. He does not, in his letter to us, go into detail as to his reasons for taking out the patent, but, presumably, leaves the patent specification to speak for itself. Nor does he state whether the Curtiss company ever built a machine of this type. One should, of course, bear in mind that the drawings and wording of a patent specification are nearly always deliberately misleading in that they are designed to cover the general idea for purposes of patent protection, whilst at the same time giving potential rivals as little information as possible about what it is actually intended to do.

By way of describing the T. P. Wright "Loppy" we could hardly do better than quote from the patent specification, which states: "In general, the airplane selected for illustration of my invention is different from the usual airplane now in use in that one wing is larger than the other wing, being longer and also being thicker. The single motor is mounted on brackets on the larger wing, and the weight thereof is counterbalanced by the increased lift of the larger wing. The offset thrust of the motor is counterbalanced by the increased drag of the thicker wing and, if desired, by a suitably cambered vertical fin."

A Red Herring?

Above we referred to the likelihood that the text and illustrations of patent specifications may be deliberately misleading. On reading through the T. P. Wright specification we find, a little farther on, the following cautionary paragraph: "It is to be understood that the above-described embodiment of my invention is for the purpose of illustration only, and various changes may be made therein without departing from the spirit and scope of my invention." So we are still left guessing as to what was actually in the mind of Mr. Wright.

Perhaps a little more light may be thrown on the subject by referring to the "objects" of the invention. These are stated as follows: "One object of my invention is the provision of increased visibility in airplanes of the single-motored type. A further object is the arrangement of the parts of such an airplane in a way that it is possible to provide a practical airplane of the pusher type using only a single motor. A further object is the reduction of fuselage vibration in airplanes of the above-described type. A further object is the reduction of the effect of motor fumes upon the occupants of an airplane of the above-described type. A further object is the reduction of the hazards of a crash in airplanes of said type. This is accomplished by reducing the fire hazard and also by reducing the hazard

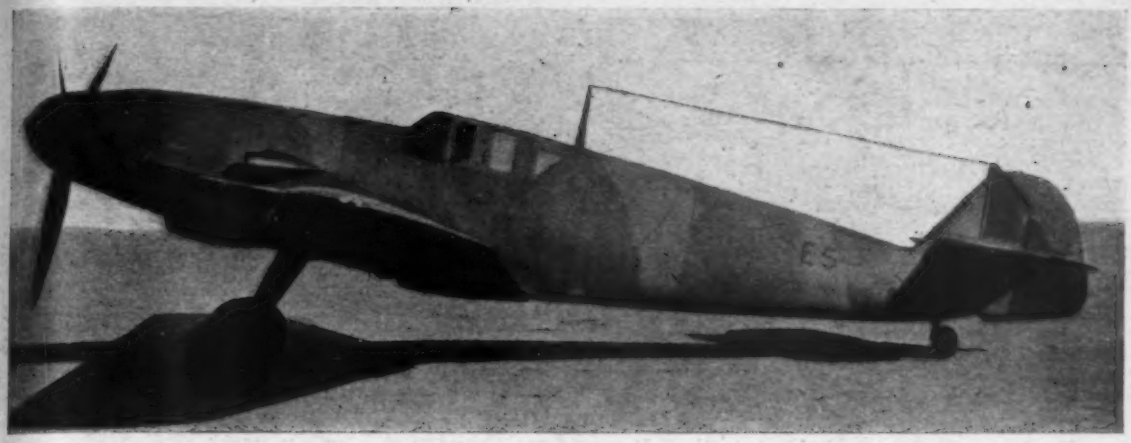


of the weight of the engine falling upon the occupants of the airplane or vice versa."

Well, at any rate some quite reasonable objects are disclosed in the above. But there must have been some snags somewhere, otherwise we should have seen a number of Curtiss aircraft of the "Loppy" type. It would be interesting to know if these were discovered during the design stages, or if a machine was actually built before they came to light. What does seem to be certain is that Mr. T. P. Wright had the idea of the asymmetrical aircraft long before the Germans thought of it.

Rolls-Curtiss P40.F.

THE Rolls-Royce Merlin, as made by the Packard Company, is being applied to the Curtiss P40.F. fighter. The performance of this machine has astounded the critics, the speed given being 400 m.p.h. It is estimated that it has a ceiling of 25,000 feet, "a very real improvement in performance." The fire power of the new Curtiss has not been definitely announced, but an American contemporary says that it is estimated that there are five or six .50 calibre machine guns in each wing. In a chart issued by the Curtiss Company it is shown that of the Curtiss Hawk pursuit types, taking the P36 (Mohawk) as 100 per cent., the P40.F. has a striking power of 667 per cent., a speed of 123 per cent., and a high-altitude performance of 170 per cent. It is from these figures that the estimated ceiling quoted above has no doubt been obtained.



Side view of the Me 109F. Compared with the 109E it has a smaller diameter airscrew, a larger spinner, a slightly smaller rudder and a cantilever tailplane.

THROUGH BRITISH EYES

A Critical Examination of the Original Messerschmitt Me 109E, the Changes Incorporated in the 109F, and Some Handling and Performance Tests

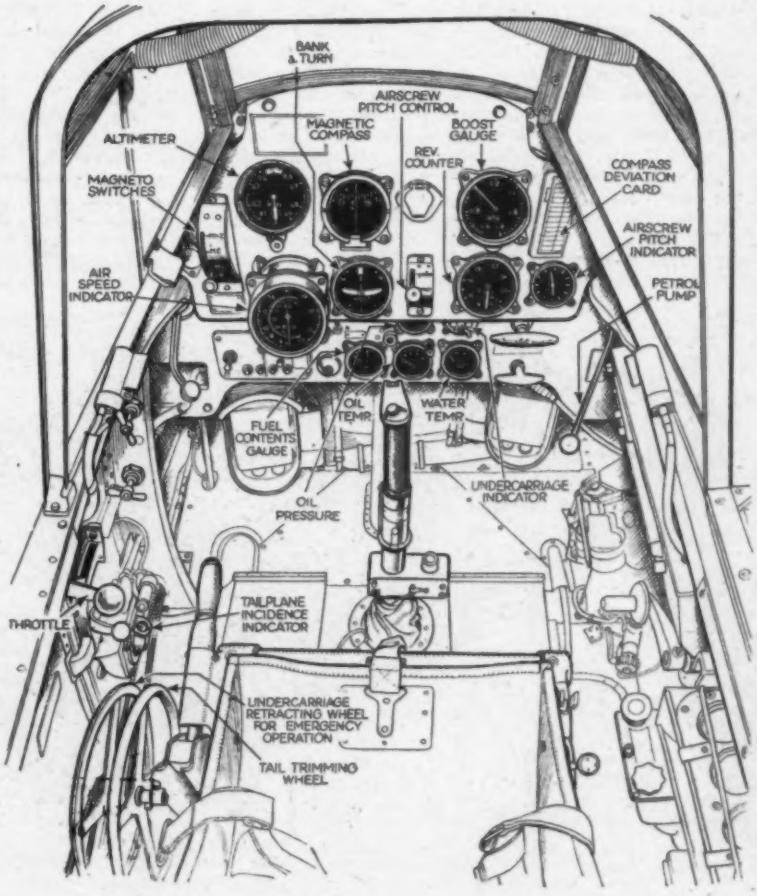
REPORTS of new German fighters notwithstanding, the Messerschmitt Me 109 is still Germany's mainstay in the single-engined fighter class. The original Me 109E was fully described and illustrated in *Flight* of October 24th, 1940. Since then modified versions have appeared, to which we have referred, and pictures of which we have published from time to time. By the courtesy of Lt. Col. Moore-Brabazon, Minister of Aircraft Production, it has now become possible to publish an even more critical and detailed examination of the original machine, an outline of the main respects in which the newer model, the Me 109F, differs from the original, and to give some results of handling and performance tests.

We feel sure that many of our readers, and more particularly those in the aircraft industry and in the Royal Air Force who have had no opportunity to see the Messerschmitt fighter, will welcome this authoritative evaluation of the merits and demerits of the design, its handling characteristics as ascertained by British pilots, and the features which have caused the later version to be such an improvement on the original in many respects.

Handling Characteristics

General.—The Me 109 is a modern stressed-skin low-wing monoplane, powered by a Daimler-Benz DB 601 1,150 h.p. inverted V-12 liquid-cooled engine. The following notes on handling characteristics apply only to the Me 109E, no flying experience having yet been obtained on the more recent version of the Me 109F.

The general conclusion on this aircraft is that, although



This copyright *Flight* sketch shows the layout of the original Me 109E cockpit. The cramped position of the pilot is referred to in this article.

THROUGH BRITISH EYES

The handle of the control column has a safety catch over the gun trigger switch.

it handles well and has excellent response to the controls at low speeds, all the controls become far too heavy at speeds in excess of 300 m.p.h., the ailerons in particular being virtually solid at 400 m.p.h. This restricts manœuvrability. Turning circle is also poor, being, for example, 885ft. at 1,200ft., due to the high wing-loading. Wing-loading on the Me 109 is 32 lb./sq. ft. These disadvantages greatly detract from the fighting qualities, but are to some extent offset by:—

Good performance at altitude, the machine having an absolute ceiling of 37,500ft.

Excellent rate of climb; this is developed at low air-speed, hence the angle of climbing is very good.

The direct-injection engine does not cut out or splutter under negative "g" as when diving suddenly to seek shelter in cloud.

The stall is very gentle even under "g," with no tendency to spinning, and ample warning of the approach of the stall is provided by the aileron vibration and buffeting which sets in as the stall is approached. Owing to high wing-loading, however, stall occurs at quite high airspeeds.

Outstanding points in relation to handling are detailed below:—

Take-off.—Flaps are lowered 20 deg. for take-off, the run being remarkably short, the initial rate of climb excellent.

Landing.—Landing is somewhat tricky until the correct technique is acquired, since the aircraft has to be rotated through a large angle on touch down, due to the abnormally high ground attitude. The wheels are positioned well forward of the C.G., and this allows fierce braking immediately on touch down without causing tail-lift, resulting in a short run. The aircraft can be taxied fast.

Flying Controls.—The flying controls have excellent response and "feel" at low speeds, but are far too heavy for manœuvring at high speeds. The extreme heaviness of the ailerons makes rolling almost impossible at speeds above 400 m.p.h.

Trim.—The only trimming control adjustable during flight is that of the variable incidence tailplane. Ground adjustment is provided for trim of ailerons, rudder and elevator by bending specified parts of their trailing edges.

The absence of a rudder trimmer is severely felt, since there is a large change of directional trim with speed, and at high speeds the continuous application of rudder necessary to fly straight is very tiring.

Flaps.—Lowering the flaps produces a nose heaviness which can be readily counteracted by adjustment of tailplane incidence, an operation made easy by the juxtaposition of control handwheels of flaps and tailplane for simultaneous operation.

On the Me 109E the ailerons are interconnected with the flaps and come down 11 deg. with them; this does not detract from the effectiveness of the ailerons, but makes them feel heavier. This interconnection is not present on the Me 109F.

The very simple and effective flap-position indicator is worthy of note. Lines painted on the slotted flaps at 10 deg. intervals lie under the trailing edge of the wing and successively emerge into the pilot's view as the flaps are lowered. Take-off and landing positions are indicated by differently coloured lines.

[This arrangement, simple and useful in a day fighter, would be of little help on a night fighter.—ED.]

Cockpit Control Arrangements

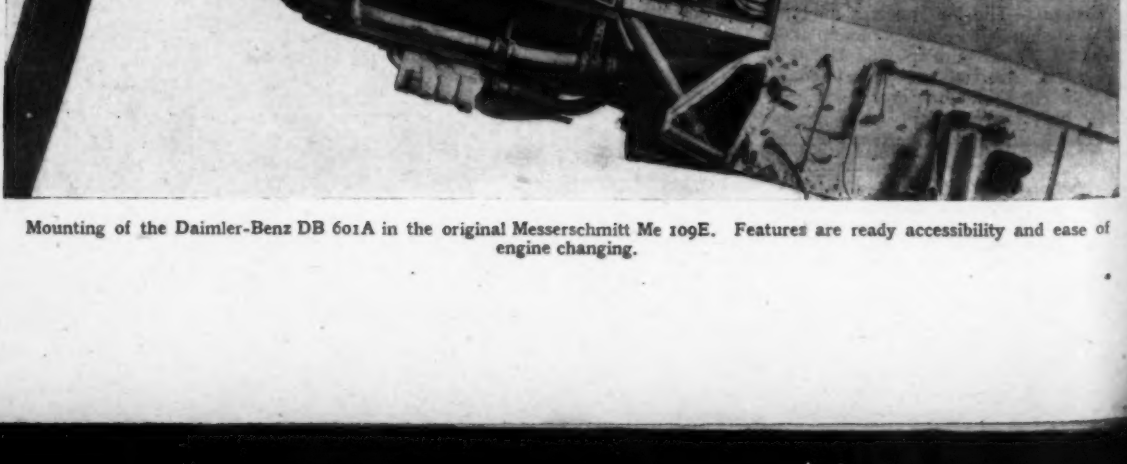
General.—The cockpit is too cramped for comfort. It is too narrow, has insufficient head-room and a tiring seating position. The cramped position seriously restricts the force which the pilot can exert on the control column, particularly in the lateral direction for aileron operation.

Flying Controls.—The control column, with its offset grip, is well positioned, but the absence of fore-and-aft adjustment for the rudder pedals is a bad feature.

Trimming and Flap Controls.—The variable incidence tailplane and the flaps are controlled by two coaxial handwheels arranged close together to be operated simultaneously by one hand, whereby change of trim due to flap operation is readily corrected.

Flap operation is entirely mechanical, by screw-and-nut gear, thus avoiding the vulnerability inherent in hydraulic systems.

Engine Controls.—A feature of the engine controls is the extreme simplicity afforded by the degree of automaticity achieved. Thus the throttle arrangements comprise only



Mounting of the Daimler-Benz DB 601A in the original Messerschmitt Me 109E. Features are ready accessibility and ease of engine changing.

The radiator exit flaps of the Me 109F closed and open.

The operation is automatic with a manual over-ride.

a single lever with no gate or over-ride. The following list indicates the more important engine functions which are performed automatically:—

Mixture.

Supercharger speed (variable-slip Föttinger hydraulic coupling).

Coolant temperature. (On the Me 109F only, the radiator exit flaps are controlled by a thermostat in the coolant circuit operating the flaps hydraulically. A manual over-ride is provided.)

Oil temperature. (On the Me 109F only, the oil cooler exit flap is controlled by a thermostat operating through pressure in the engine lubrication system.)

Airscrew. (Constant-speed governor-controlled airscrew pitch-changing devices are found on some, but not all, engines. A hand pitch control lever is mounted on the dashboard.)

Brakes.—The brakes are foot operated, each rudder pedal being arranged to rock and operate on a master cylinder which applies the brakes hydraulically. The brakes are good, but a hand-operated system is thought to be more sensitive.

Instrument Panel.—The instruments are well grouped, with flying instruments on the left and engine ones on the right. A bad feature on the Me 109E is the absence of a gyro horizon.

View.—During flight the view is similar to our own fighter aircraft, but, due to the cramped seating position, the tailplane can only be seen with an effort.

The cockpit hood hinges along the starboard side and so cannot be opened in flight. The arrangements for jettisoning this hood are outstanding, the hood being spring-loaded so as to be flung clear, together with the wireless mast, when the jettison lever is operated. This is an excellent feature.

During taxying the view ahead is very bad, due in part to the high ground attitude and to the fact that the hood cannot be opened to obtain a view round the side.

A good feature is the direct-vision opening provided by the front corner panel on the port side of the windscreen. This panel is vertically divided into two parts, the forward one of which hinges inwards about its leading edge, forming a 2in.-wide direct vision opening which is completely draught free and greatly facilitates the maintenance of high flying speeds in rain or snow.

The windscreen is not fitted with bullet-proof glass. The plastic transparencies of the hood are of very good quality and do not oil up in flight.

Maintenance Provisions

General.—Great care has obviously been exercised in the design stage of all German aircraft to ensure ease of maintenance, requiring a minimum amount of skill. The following brief notes cover some of the outstanding points.

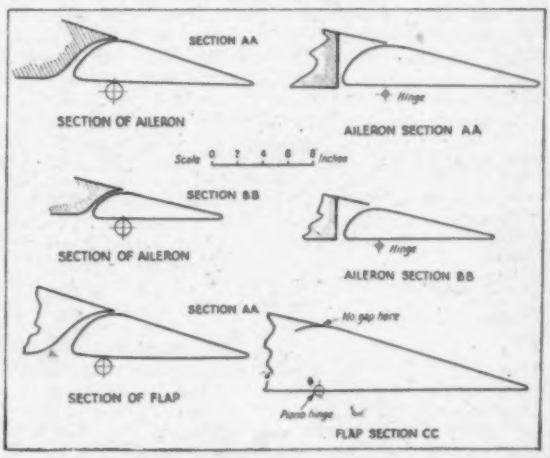
Inspection Doors.—Inspection doors are very liberally provided and are usually locked by a single fastener. On the Me 109 the doors are mostly hinged and are locked and released very simply, without tools, by a single neat flush-fitting fastener of the spring-loaded push-button type. The doors are always a good flush fit when closed and they spring open when released. Wing guns, in particular, are very accessible through a large door hinged along its leading edge.

New Cowling Fastener

Engine Cowling.—Engine cowling is in three large sections. The top two, which cover well down the sides, are permanently joined at their top meeting edges and are held down by two pairs of push-button fasteners and a single bolt at the front. A new type of cowling fastener comprises a quick-pitch round-threaded pointed screw, trapped in the cowling and engaging nuts formed by cup-shaped pressings having two thicknesses of metal displaced relatively to form a coarse thread.

Sparking Plugs.—The sparking plugs are very accessible, being all situated on the outside of the cylinder banks.

Fairing.—An interesting new type of attachment has appeared on the wing root fairings of the Me 109F. A stranded cable passes round pulleys on the fuselage and through loops inside the fairing so that by pulling the cable up tight by means of a single turn-screw, the fairing is drawn into position. Leather packing ensures a snug fit at the edges of the fairing, but this method, by eliminat-



Compliment to Bristol designer. On the left, sections of the original aileron of the Me 109E. On the right the Frise type introduced in the Me 109F.

Trailing its coat. The radiator flap, plain flap, and aileron of the Me 109F together form a completely movable trailing edge. Another feature of Messerschmitt's latest version is the placing of the wheels far forward. This prevents nosing over, but requires a special landing technique.

ing all the usual screws or clips, presupposes a fairly accurate shaping of the fairing.

Greasing.—Grease nipples are of the Tecalemit (grooved type) and are all painted red. Airscrew hubs are also lubricated by grease-gun, necessitating removal of the spinner. This is a simple matter requiring only a single tool inserted through a slot marked red at the rear edge of the spinner, the tool being then turned to free a spring-loaded toggle lock which allows the spinner to be turned to release a number of grooved locking pegs around its inner periphery. The spinner can then be withdrawn forwardly.

Hydraulic System.—There is little of interest from the maintenance point of view. The reservoirs for the master cylinders of hydraulic brakes in the 109F are now formed integrally with the simple strut piston-and-cylinder assembly which is linked between the rudder pedals and fixed points. They are filled through a ball non-return valve, thus necessitating use of a syringe.

Air Inflation.—A standard air inflation valve for all services has not yet been observed. Tyres have the usual Schrader valve; oleos an enlarged version of the Schrader with a screwed coupler; and air bottles a large common external connection adapted to receive a bayonet type quick coupler.

Oxygen Inflation.—Oxygen bottles are charged at an external filling point on the skin of the aircraft. This filling point is screwed to receive a dust cap or the hose coupler.

Refuelling.—The Me 109 is fitted with a refuelling point on the skin of the side of the fuselage leading into the side of the tank. The coupler on the fuelling hose is of the quickly attachable type.

Comparative Data for Me 109E and Me 109F2

Data.		Me 109E.	Me 109F2.
Wing.			
Span	(ft.)	32.4	32.7
Gross area	(sq. ft.)	174	173.0
Mean chord	(ft.)	5.36	5.29
Ailerons.			
Type		Slotted	Frise
Span	(ft.)	11.4	9.84
Area	(sq. ft.)	11.0	10.84
Mean chord	(ft.)	0.964	1.10
Volume coefficient		0.050	0.046
% set back hinge balance		21.6	23.0
Flaps.			
Type		Slotted	Plain
Area	(sq. ft.)	24.8	20.0*

* This area includes that of both inner and outer portions.

THROUGH BRITISH EYES

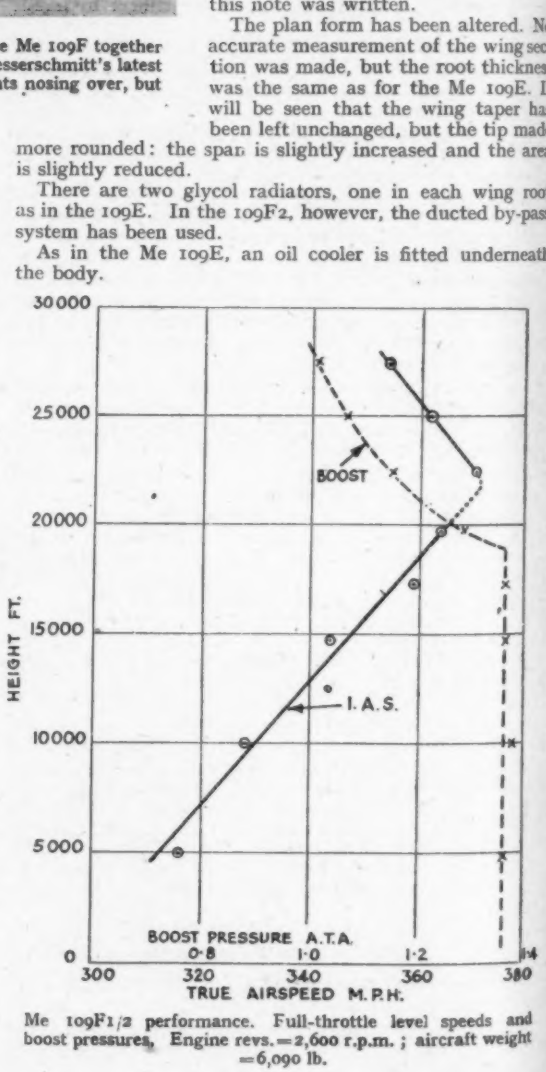
Aerodynamic Features of the Me 109F2 and Comparison with Me 109E

The data given in this note result from an examination of a Me 109F2. This fighter is basically a Me 109E (the ordinary Me 109) with a number of modifications, the most obvious of which is the rounding of the wing-tips It was for the purpose of noting the aerodynamic modifications that this note was written.

The plan form has been altered. No accurate measurement of the wing section was made, but the root thickness was the same as for the Me 109E. It will be seen that the wing taper has been left unchanged, but the tip made more rounded: the span is slightly increased and the area is slightly reduced.

There are two glycol radiators, one in each wing root as in the 109E. In the 109F2, however, the ducted by-pass system has been used.

As in the Me 109E, an oil cooler is fitted underneath the body.



Me 109F1/2 performance. Full-throttle level speeds and boost pressures. Engine revs. = 2,600 r.p.m.; aircraft weight = 6,090 lb.

THROUGH BRITISH EYES

Each flap is divided into an inboard and outboard part; the former consists of two portions, which are capable of simultaneous downward movement (thus acting simply as a wing flap) or of opposite movements (acting as radiator flaps). The former motion takes place when the outer flaps are lowered. The latter motion is under the control of a thermostat placed between the glycol header tank and the radiator.

It will be noticed that both the flap span and area are less for the 109F2 than for the 109E.

The ailerons have been reduced in span and increased in chord from those of the 109E, the area, however, remaining almost unaltered: the type has been changed from slotted to Frise. Two diagrams give sectional views of the two types of ailerons.

The ailerons are fitted with small tabs for ground adjustment only, as in the 109E. External mass balance weights are fitted as in the 109E, but the ailerons do not come down with the flaps.

The leading edge slats are of rather less span than for the 109E, but otherwise of similar design.

A cantilever tailplane placed slightly below and forward of the original position replaces the braced tailplane of the 109E; it remains adjustable in flight. The elevators of the Me 109F2 are now over mass-balanced; at zero elevator angle the residual weight moment for both elevators about the hinge is of the order of 10 lb.-ft. tending to pull the elevators up. The elevators of the Me 109F1/2, however, are identical with those of the 109E, both being approximately mass-balanced. The obvious difference between the two elevators is that on the 109F2 the (lead) mass-balancing weight is screwed to the nose of the horn and can be easily detached, whereas on the 109F1/2 and 109E the weight is enclosed in the metal skin of the horn.

The rudder area has been reduced from 8.1 to 7.5 sq. ft. The fin section has also been cambered (on the 109E the section was symmetrical), presumably to reduce the amount of rudder needed on the climb.

The original armament of the 109E is replaced by a 15 mm. cannon firing down the airscrew shaft and two machine guns mounted in the usual position over the engine; the only alteration from the 109E is, therefore, the omission of the wing guns. The fuselage seems to be the same as that of the 109E, except that external strengthening plates are screwed on to the sides of the fuselage near the rear as though to strengthen it in bending about the vertical axis.

Brief Performance Tests on a Me 109F1/2 (DB 601N.)

Brief performance tests on a Me 109F covered the following points:—

Determination of the full throttle level speeds at a series of heights from 5,000ft. to 27,500ft.

Full throttle partial climbs at 5,000ft. and 20,000ft.

The result so far obtained indicate that the maximum level speed is 371 m.p.h. T.A.S.; it is obtained at about 22,000ft., although boost pressure starts falling off at 19,000ft. The maximum rate of climb at 5,000ft. is 3,320 ft./min., and at 20,000ft. is 2,370 ft./min. Full throttle and 2,600 engine r.p.m. were used throughout.

All the above figures are applicable to the aircraft flying with its full service load, all-up weight 6,090 lb., wing loading 35.2 lb./sq. ft.

Description of the Aircraft

The Me 109F1/2 is a development of the Me 109E. The following are the more important differences between the two types which may affect performance:—

The wing plan form has been modified; the wing tips are now rounded, with only slight changes in span and area.

The radiators, which are in the same position as on the Me 109E, incorporate a boundary layer by-pass; this collects the boundary layer on the lower wing surface immediately ahead of the radiator, leads it round the top of the radiator and discharges it at the trailing edge. This has allowed the radiators to be sunk farther into the wing and they now project only about 2.5in. The oil and coolant radiator flaps are thermostatically controlled, but a pilot-controlled over-ride is provided to open the coolant radiator flaps.

The tail wheel now retracts.

The braced tailplane has been replaced by a cantilever tailplane.

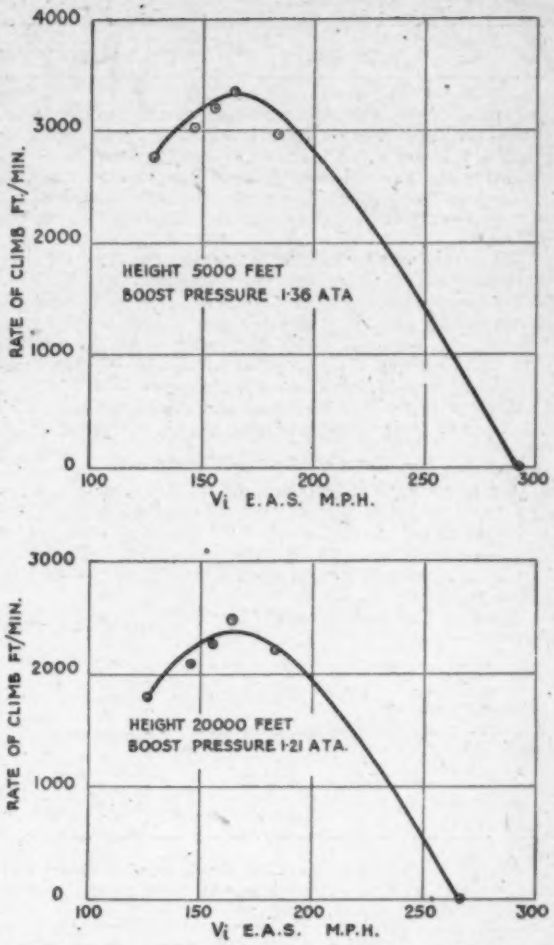
The DB 601A engine installed in the Me 109E has been replaced by a DB 601N. The chief differences between the two engines is that piston tops are now flat instead of concave; the compression ratio has thereby been increased from 6.9 to 7.9. Bench tests show that the sea-level B.H.P. of the DB 601N is 1,085, compared with 985 for the DB 601A.

The air intake to the supercharge has been redesigned. The entry is farther out from the side of the fuselage than on the Me 109E, probably in order to obtain a greater ram effect.

The airscrew diameter has been reduced from 10.2ft. to 9.7ft., and the diameter of the spinner has been increased.

The petrol capacity of about 80 gallons is slightly less than that of the 109E. Provision is made to carry a jettisonable tank slung under the fuselage.

The airscrew has now been fitted with a constant-speed unit of novel design. The r.p.m. at which the airscrew



Full-throttle partial climbs of Me 109F at 5,000ft. and 20,000ft. Engine r.p.m. = 2,600 and aircraft weight 6,090 lb

THROUGH BRITISH EYES

is controlled depend on the position of the throttle lever. With the throttle lever fully forward the unit is set to control at 2,600 r.p.m.; when the throttle lever is moved back the r.p.m. automatically fall an appropriate amount.

The constant-speed unit can be cut out by the pilot and the airscrew pitch controlled in the same way as on the Me 109E.

The normal service load of the aeroplane with two M.G.17 machine-guns firing through the airscrew and one M.G.151 firing 20-mm. ammunition is 6,090 lb. The aeroplane was flown at this loading, which is about 500 lb. heavier than that of the Me 109E. The wing area of the Me 109F is 173 sq. ft., giving a wing-loading of 35.2 lb./sq. ft., compared with 32.1 lb./sq. ft. for the Me 109E.

Photographs of the aeroplane and of the radiator, with the flaps in their closed and open positions, are attached.

Programme of Tests

The programme of tests covered the following points:—

Determination of the position error curve.

Measurement of full-throttle level speeds at 2,600 engine r.p.m. at heights from 5,000ft. to 27,500ft.

Partial climbs at 5,000ft. and 20,000ft. at full throttle 2,600 engine r.p.m.

The following table gives the limitations of the DB 601N engine:—

	Boost Ata.	r.p.m.
5 minutes ..	1.34–1.4	2,600
30 minutes ..	1.3	2,400
Continuous ..	1.2	2,300

At full throttle the boost on the engine used was controlled at 1.36 ata. The tests were done at full throttle at 2,600 engine r.p.m.

All the results were corrected to the take-off weight, 6,090 lb.

Results

Position error curve.—The aircraft was timed at various speeds over a 7½ miles speed course in order to establish the position error.

Level Speeds.—The full-throttle level speeds and the corresponding boost pressures at 2,600 engine r.p.m. are shown plotted against height in the chart. The engine was allowed to cool between each level so that the thermostatically controlled radiator flaps would be closed.

Speeds were corrected on the density basis and boost on the half-and-half basis above the supercharged height. Below this height both were corrected on the pressure basis.

The maximum level speed with radiator flaps fully closed is 371 m.p.h. at about 22,000ft.

An interesting feature is that whereas the full-throttle height as indicated by boost pressure is 19,000ft., the maximum level speed is obtained at about 22,000ft. This phenomenon was also observed on the Me 110. Discussion of this apparent anomaly is deferred until the DB.601 engine has been tested on the altitude test-bed.

Partial Climbs

Partial climbs were done at 5,000ft. and 20,000ft. The rates of climb are shown plotted against E.A.S. in a graph. The climbs were done at full throttle at 2,600 engine r.p.m. and have been corrected to the normal load of 6,090 lb.

At 5,000ft. the maximum rate of climb is 3,320 ft./min. at 165 m.p.h. E.A.S., the boost pressure being 1.36 ata. At 20,000ft. the maximum rate of climb is 2,370 ft./min. at 165 m.p.h. E.A.S., the boost pressure being 121 ata.

The rate of climb of the Me 109F at 20,000ft. seems rather low in view of its reputed ceiling of about 40,000ft. It should be borne in mind, however, that the engine gave trouble and that the results contained in this note merely represent the best obtained under test. They do, however, give a useful guide to the minimum performance of the aircraft.

LORD TRENCHARD ON AIR POWER

"Air Must Dominate Strategy."

VISCOUNT TRENCHARD made a very important speech in the House of Lords on Thursday, January 29th. He began by welcoming Lord Moyne's statement that in Russia, Britain and the Middle East we well knew that the key to success lay in the balance of air power. He regretted that in this war air power has often been used wrongly or not used at all. One reason for our setback in the Pacific was that 15 or 16 years ago the Government would not agree to make Singapore an air base in peace time. The Army and Navy only wanted aircraft to spot for the big guns; the Air Service wanted to make it an air base as the best defence, and as it had possibilities of a great air offence from that base.

Lord Trenchard went on to state certain facts which governed, and would always govern, the use of air power in war. They were of paramount importance but were still imperfectly understood by many critics. He thought that most of the public felt that our setbacks in Norway, Greece and Crete were due to the air, and that the Germans used their air more efficiently than we did. The same was felt by many as regards Malaya.

To sum up, the setbacks and victories on both sides in this war had been due chiefly to air power. The Army, and the Navy in narrow waters, could not fight successfully without air cover, without air support, and without air superiority. Short-range fighters were always—and always would be—superior to long-range aircraft. The geographical position affected the air force more than it affected the other services. We must choose, as far as possible, our battleground.

If those vitally important considerations were overlooked or ignored it was no earthly use blaming the R.A.F. for lack of co-operation, bad organisation, or anything else. Of course, the Royal Air Force authorities must draw attention in Council to those factors when knowledge of them appeared to be lacking. But if, after making clear the facts—and they were facts which were universally recognised as fundamental by the Royal Air Force—their advice or warnings were not followed, then the true responsibility must rest elsewhere.

If their lordships believed what he had said, and he believed that nobody who was well informed could deny it, and if it was recognised by all, then it meant that air must dominate strategy. He did not mean that air could win the war without the Army and the Navy. It could not, but it must dominate strategy. He asked their lordships to influence all with whom they came in contact to understand these very simple facts, because on them bore the successful conclusion of this war.

ADVERTISED GOODS

THE fact that goods made of raw materials in short supply owing to war conditions are advertised in this journal should not be taken as an indication that they are necessarily available for export.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

CONVOY FIGHTERS

Retractable Float Idea Criticised

AS regards Mr. Lacey's letter on the retractable float-plane fighter, referred to in *Flight* of January 8th, I would like to make a few comments.

In order to counteract the severe strain set up on impact of landing, gear of a very heavy and robust construction would have to be employed. If "straight gear" were used, an extremely bulky fuselage would be required to contain the mechanism, whereas, on the other hand, if jointed gear were used it could be more easily accommodated in a streamline fuselage, although the drag stresses set up by a 60-80 m.p.h. landing would distort, if not break, the gear at the joints.

Due consideration must also be given to the fact that the float, when being lowered, moves forward as well as downward. This instance would tend to create longitudinal instability.

In order to give the engine and airscrew satisfactory clearance from spray, the float would have to be projected at least 9ft. from the datum line. This would necessitate "anti-bend" bracing, which amplifies my statement on weight and bulkiness.

Finally, with reference to Mr. Lacey's suggestion for the use of a twin-row radial power unit, it will be noted that the world's fastest radial-engined fighters (American) have a top speed considerably less than 400 m.p.h.; therefore, the speed of the machine under discussion would be still further reduced owing to its cumbersome equipment. G. BEEKEN.

THE TANK-BUSTER

12-Pounder Gun Suggested

AFTER hearing of the difficulty of our Hurry-bomber pilots in getting their bombs and a moving tank to get together at the right moment without writing themselves off, or seeing their bombs go off in the blue, I have wondered why the obvious remedy of mounting a gun heavy enough to be effective, say a 12-pounder, has not been adopted. It could be mounted torpedo fashion, or inside the fuselage of a Blenheim type. The recoil could be almost any length to slow down the impact of discharge, and the aiming left to the pilot.

The penetration of such a gun would be sufficient to account for even the heaviest tank, and since only about three seconds would elapse from pressing the trigger to the explosion of the shell, a tank would have to be phenomenally swift to avoid it. Against shipping it should be equally effective, and the plane could stay outside the light flak area.

A Bofors type feed with the magazine immediately above it should look after that end.

Aircraft seem to be the only means of getting at tanks before they can do any damage, and the gun-bus seems to be the most effective way of doing it.

I should imagine that a flying battery of six guns, with fighter escort, could do quite a lot of damage to a tank column from, say, 5,000ft. to 1,000ft., and one hit would be sufficient for most tanks, or, if in the boiler room of a vessel, quite a lot of good should result. LETUSDO IT FIRST.

TOO MANY DIALS?

A Naval Pilot Replies

I WAS interested to read in the issue of *Flight* for January 8th, "Kismet's" article on "Too Many Dials." I can only argue with him on the score of fighter aircraft as I do not know much about multi-engined types. But in his drastic reductions for his second squadron of fighters, he does not even concede a turn and bank indicator or fuel gauges.

An aircraft can fly blind without the directional indicator, artificial horizon and climb and descent indicator, but, in my opinion, it puts considerably more strain on the pilot. It is imperative to have some indication of turning when blind flying, and "Kismet" cannot surely argue that this is unnecessary, as who can tell when a pilot may not be forced to fly through cloud?

As regards fuel gauges, surely a pilot cannot be relied upon to guess the probable contents of his tanks, and is it not important that he should know what he has left?

I also noted with amusement that, as a parting gesture, he tells of a car he drove at Brooklands which had only three instruments—two of which are of the kind he would like to see abolished in aircraft!

Finally, I would be interested to know how many yards farther an aircraft could fly without any instruments and attachments. I feel sure that the perecentage weight of these is almost negligible.

Hoping this does not arouse a National controversy!

S/Lt. (A), R.N.V.R.

A Justification of Instruments

WITH reference to "Kismet's" article on "Too Many Dials" in your issue of January 8th, his arguments are so weak and show such a surprising lack of technical knowledge that I can only assume he wrote it to provoke a discussion.

Although everyone deplores the fitting of unnecessary instruments, it is difficult to select any one which could be left out of the standard set fitted to all Service types, when their respective uses are analysed. It would certainly be impossible to find the odd cwt. and a half which he suggests might be saved by the reduction in the number of instruments.

Though I do not doubt "Kismet's" ability to fly an aircraft around an airdrome, or even to pull off a cross-country in fine weather by Bradshaw, it is quite evident that he knows nothing about serious cloud flying, and still less of the hazards of operational flying. If he did, he would know that if more pilots understood their instruments, and in particular their engine instruments, more crews and valuable aircraft would be saved by the pilot's returning to the nearest airdrome when he realised his engine installation was failing. Obviously, the pilot does not study his instruments during a dog-fight, but what after? With an oil or coolant pipe damaged over the Channel, is it better for him, knowing nothing as "Kismet" would have it, to throw away his life unnecessarily by attempting to return to his base, or to have some warning and park down by the nearest ship, thus saving his life to fight again? Or, even when operating over friendly country, isn't it better to be warned in time and land on the nearest airdrome rather than crash a good aircraft through a forced landing whilst trying to reach his home base?

How, too, does "Kismet" expect the ground crews to maintain their aircraft and keep them up to concert pitch, which is so essential for fighting? Is it fair or economical for the Engineer Officers and mechanics to receive their first intimation that all is not well by the pilot's failing to return, or a telephone call from an obscure police station informing them that an aircraft has crashed whilst forced landing due to an engine failure or to running out of fuel?

"Kismet" writes, referring to oil: "Is it really essential to know the pressure, flow, ingoing and outgoing temperatures?" And, later: "Can anyone prove that an analysis of the exhaust gases is indispensable to a returning bomber?"

For his information, no aircraft other than experimental ones are fitted with flow-meters or outgoing oil thermometers. Surely, too, he knows that with constant-speed airscrews, if automatic mixture controls are not fitted, the exhaust gas analyser is the only means by which the pilot can adjust his mixture strength to give him maximum range. In any case, these analysers are not fitted to any aircraft with British engines, as the latter are all fitted with automatic mixture controls.

It may interest him to know that the approximate weight of all the engine and aircraft instruments in the latest type single-seater fighter is 25½ lb., including clock and oxygen regulator. Even if this weight increased in proportion to the number of engines fitted, which it does not, he would still have a long way to look to find his extra cwt. and a half.

With regard to his story with a moral, I am afraid I cannot see the parallel. Are we to understand that because he can drive a car round Brooklands at 180 miles per hour without any instruments, a pilot has no need of instruments to guide him on his way or to warn him that his engine requires vetting before his next trip across the North Sea?

P. G. LUCAS.

CORRESPONDENCE (Continued)

RANGE AND FUEL ECONOMY

Mr. Hinings Taken to Task

IN his article in *Flight* of December 11th, 1941, Mr. C. L. Hinings stated that "Flying at maximum lift/drag ratio gives greatest endurance but not greatest range." This should read "Flying at maximum lift/drag gives greatest range but not greatest endurance." Similarly, the paragraphs marked (2) and (3) are incorrect.

Range.—The energy of the fuel is used up in overcoming the drag of the aircraft over a certain distance, hence the greatest range is obtained when the drag of the aircraft is a minimum, i.e., when the overall lift/drag ratio is a maximum.

Endurance.—The energy of the fuel is used up in overcoming the drag of the aircraft through a certain distance, but the distance flown is equal to speed multiplied by the endurance, so that the maximum endurance is obtained when the drag multiplied by the speed is a minimum. This occurs at a lower speed than that corresponding to flight at maximum lift/drag ratio.

A. H. CRAWFORD,
Assistant Chief Designer.

Blackburn Aircraft, Ltd.,
Dumbarton.

An Attempt to Help the Pilot

ONE of the most valuable contributions that a technical journal of the standing of *Flight* can make to the common purpose is to wheedle out some of the accumulated knowledge possessed by its readers in the form of letters in the Correspondence columns. The article by me which you published in your issue of December 11th, 1941, seeking to "marry" the power plant to the aircraft (pilot as best man), begins to serve its purpose in that comments have been drawn from Mr. Hick and Mr. Tennant, both obviously aerodynamic chaplains. (See issues of December 25th, 1941 and January 1st, 1942.)

Incidentally, it is only fair to myself to point out that I did not seek to write an article, in which case I should have preferred to tackle the subject from a different standpoint to "Jinair," and would have avoided using mathematical symbols such as L/D entirely. My contribution was intended for the Correspondence columns, as a modernised addendum to "Jinair's" original article. It should be regarded first and foremost as a plea to cut out the mathematical argument, eliminate the theories of aerodynamics, and attempt to give the pilot something intelligible and helpful in the actual handling of the aircraft in the air. Therefore, although, as Mr. Tennant points out, the point of minimum power on the aircraft "H.P.-required" curve does not tally with maximum L/D, but maximum $L^{3/2}/D$, this does not invalidate my statement to the pilot that for maximum endurance his practical procedure will be to reduce his A.S.I. to a value at which "his aircraft is just pleasantly manœuvrable and responsive to controls above the stalling speeds, and at a fairly low altitude."

Furthermore, this maximum endurance A.S.I. is considerably lower than the speed which will give him maximum range as recommended invariably by the manufacturers, after confirmation from the competent A.M. Research Establishment. A further point to note is that owing to the flat peak of the range curve, a rather higher cruising A.S.I. may be recommended, as the very small decrease in range is more than compensated for by the operational advantages of the greater speed. A proper comprehension of these two aircraft speeds, each with its own importance, clears the way for the main body of my contribution, which was to indicate how best the modern supercharged engine, with constant-speed airscrew, can be employed to give the power required at each of the aircraft speeds, and, incidentally, to outline very briefly the operational functioning of the power plant.

I propose leaving it to Messrs. Hick and Tennant to argue it out between them, as aerodynamic experts, whether, on the one hand, power required varies as $L^{3/2}/D$, or as $C_L^{3/2}/C_D$, about which they appear to differ. With all due respect, I do not think that the average pilot will be greatly enlightened.

Mr. Hick arrives at a rather delightful conclusion that "the less petrol you use per mile, the further you can go per gallon," or, in other words, the lower the gallons per mile, the higher the miles per gallon, but it is certainly true that the specific consumptions, as shown by a family of curves over a range of r.p.m with increasing h.p., introduce an engine factor additional to the aerodynamic argument in deciding where the peak of the range curve comes.

C. L. HININGS.

ELECTRICS versus HYDRAULICS

It Depends on the Job to be Done

I HAVE read with very great interest the article by "Indicator" in the January 8th issue of your paper. This raises a question of very great interest and, indeed, of vital importance.

"Indicator" is a hydraulic man, but favours electrical control, whereas I am an electrical man and, in a great number of instances, I favour hydraulic.

I am not connected in any way with the aircraft industry, but am a maker of control gear. Now I think it may be stated that, generally, where it is desired to transmit a linear motion, short in length, slow in action and which must stay put in any desired position, hydraulic control should be adopted.

Where rotary motion is required, especially continuous running, then electric motor operation is to be preferred. There are, of course, a thousand and one considerations which may affect the case for one reason or another, but where hydraulic supply or electrical supply are equally available, then the choice of the method of control should be the one mechanically best suited.

Now electrical control may be made to do anything, but it has a number of disadvantages.

1. The speed of these motors is usually extremely high in order to reduce weight, so that an immense gear reduction has to be effected to produce a linear movement of, say, 1ft. in a minute or half a minute. The motor may be running at anything from 5,000 to 7,000 r.p.m.

2. The starting current of a motor switched direct on is the same as the stalling current.

3. There are a great number of points which require inspection and servicing with electrical gear, the brushes of the commutator, the gearings, lubrication of the gearing, limit switches, protective devices. In the case of hydraulics, practically only one protective device is necessary, and that is a release valve to prevent overloading. The operation of this valve does not stop the operation of the hydraulic device, whatever it may be, whereas if you have a fuse or an overload circuit breaker for electrical control, the moment either of these operate the whole device is out of action; either a new fuse must be fitted or the circuit-breaker reclosed.

In cases where a movement is to stop and stay put, or which comes up against a stop at either end, such as raising and lowering the undercarriage, limit switches have to be provided with a very careful adjustment. Every electrical man knows that these small auxiliary devices give more trouble than the main drive; they have to make and break contact at an exact moment and the contact has to be good and the break has to be clean. Such a device should, therefore, be designed with the greatest possible care.

I have seen one instance, on a very well-known plane, where the electrical control was thoroughly badly designed and unsuitable for the purpose, with the result that the operating motors were continually burning out. Although magnet coils with impregnated insulation and so on have now reached a considerable state of perfection, it nevertheless remains true that the whole operation of any of these controls may depend on a 30 s.w.g. diameter copper wire or finer, and copper is always subject to corrosion. Then, again, vibration is most inimical to electrical contacts and, owing to the low voltage of supply on a plane, any loss of volts at any one place, due to bad contact, is likely to prevent the device working.

"Indicator" suggests the duplication of electrical control wires, but it is surely just as easy to duplicate the pipe line for hydraulics, and in the case of the latter only two pipes are needed, whereas for reversing a motor four wires are needed.

Motor operation was tried, before the last war, for gun laying on H.M. ships and was a complete failure owing to creepage and to the extreme difficulty in arresting the movement at any exact position. An electrical motor has considerable inertia and therefore overruns after the circuit is broken unless you have some form of brake.

A good instance of the correct use of electrical and hydraulic transmission is in the case of modern machine tools, where the main spindle is motor-operated and various motions, such as traverse, feed and so on, are hydraulically operated, and you may be quite certain that if it had been possible to do the latter satisfactorily by motor drive, it would have been adopted.

As regard servicing, it should be possible to train a man to service hydraulic gear in a very short time, whereas it may take months to train a man to service electrical gear, and there are not half so many people, as "Indicator" seems to think, who are good electrical mechanics.

"ELECTRIC CONTROL."

Service Aviation

A fully armed Hurricane bomber in flight. In addition to the bombs a full battery of machine guns is carried. The Rolls-Royce Merlin now gives over 1,300 h.p.

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

From The London Gazette, Jan 27.

Air Cmdrs. to be Air Vice-Marshals (temp.).—
H. V. CHAMPION DE CRESPIGNY, M.C., D.F.C. (Act. Air Vice-Marshal).
J. M. ROSS, C.B., D.S.O., D.F.C., A.F.C. (Act. Air Vice-Marshal).
J. J. BREEN, O.B.E.
G. C. PIRIE, C.B.E., M.C., D.F.C. (Act. Air Vice-Marshal).
R. H. M. S. SAUNDBY, M.C., D.F.C., A.F.C. (Act. Air Vice-Marshal).
D. F. STEVENSON, C.B.E., D.S.O., M.C. (Act. Air Vice-Marshal).
Hon. R. A. COCHRANE, C.B.E., A.F.C.
W. A. COMPTON, C.B., M.V.O., D.F.C.
Grp. Capts. to be Air Comdrs. (temp.):—
L. O. BROWN, C.B.E., D.S.C., A.F.C.
C. E. V. PORTER.
R. A. GEORGE, M.C.
F. H. MACKWORTH, D.F.C.
W. ELLIOT, C.B.E., D.F.C.
J. W. BAKER, M.C., D.F.C.

All promotions to date from Dec 1st, 1941.

Battle Dress for R.O.C.

MEMBERS of the Royal Observer Corps are now to have a uniform of their own. The design is of blue-grey serge battle dress with shoulder straps and belt. The tunic, which has a stand-and-fall collar, is fitted with four R.O.C. buttons down the front. The shoulder straps, breast pockets and cuffs are fastened by small R.O.C. buttons. A woven circular badge bearing the words "Royal Observer Corps" with an eagle in the centre and surmounted by a crown, is worn on the left breast. The headdress will continue to be a dark blue beret bearing the R.O.C. metal badge.

Awards

Battle of Libya

IMMEDIATE AWARDS.

THE KING has been graciously pleased to approve the following immediate awards which have been made in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED SERVICE ORDER.

Act. Sqn. Ldr. M. M. STEPHENS, D.F.C., No. 80 Squadron.—In December, 1941, this officer led a bombing and machine-gun attack on enemy mechanical transport in the Acroma area. Following the attack Sqn. Ldr. Stephens observed the fighter escort in combat with a force of enemy fighters, but, whilst attempting to participate in the engagement, his aircraft was severely damaged by an enemy fighter pilot whose cannon fire exploded the starboard petrol tank. This, with the oil tank, burst into flames.

The same burst of fire wounded Sqn. Ldr. Stephens in both feet and blew out the starboard side of the aircraft's cockpit. Sqn. Ldr. Stephens then prepared to abandon aircraft, but, when halfway out of the cockpit, he observed an enemy aircraft fly past him. He immediately regained his seat and shot down the enemy aircraft.

Sqn. Ldr. Stephens finally left his crippled aircraft by parachute and landed safely on the ground, where he beat out the flames from his burning clothing. Although he had landed within 300 yards of the enemy's lines, Sqn. Ldr. Stephens succeeded in regaining our own territory within three-quarters of an hour.

Throughout, this officer displayed great courage and devotion to duty. Previously Sqn. Ldr. Stephens led his squadron on operations which were of the greatest value during the battle for Tobruk. His leadership and example proved an inspiration.

F/O. D. Passmore of No. 42 Squadron who won the D.F.C. for his attacks on shipping in the North Sea.

DISTINGUISHED FLYING CROSS.

Act. Sqn. Ldr. S. LINNARD, No. 274 Squadron.—This officer has shown himself to be an exceptionally resolute leader. In December, 1941, he led the squadron against a force of 15 Junkers 87's escorted by 15 fighter aircraft. The engagement resulted in the loss of five enemy aircraft, while the remainder were dispersed. Two days later Sqn. Ldr. Linnard led his squadron as part of a wing escort to a formation of bombers detailed to attack enemy columns between El Adem and Sidi Rezegh.

During the flight some 30 enemy fighters were encountered, but, under the skilful leadership of Sqn. Ldr. Linnard, his squadron provided protection for the bombers for some time and, when the enemy finally attacked, three of their aircraft were shot down and many others damaged. Sqn. Ldr. Linnard has participated in operational flying over a long period, including the campaign in Greece and Syria, and has always shown courage and skill.

Major M. S. OSLER, S.A.A.F., No. 1 (S.A.A.F.) Squadron.—This officer has displayed exceptional skill and leadership as squadron commander during the present campaign in Cyrenaica. In December,

SERVICE AVIATION

1941, whilst on an operational flight, Major Osler and the pilot of another aircraft became involved in combat with a large force of enemy fighters and bombers. Despite the odds, Major Osler at once attacked, and the section shot down three of the enemy's aircraft. Major Osler has destroyed seven enemy aircraft.

Flt. Lt. W. S. ARTHUR, R.A.A.F., No. 3 (R.A.A.F.) Squadron.—In November, 1941, this officer participated in an operational sweep over the Bir El Gobi area. A large formation of enemy aircraft was intercepted, and in the ensuing combat Flt. Lt. Arthur destroyed four of them. This officer has displayed great skill and gallantry on many occasions and he has destroyed at least seven hostile aircraft.

Flt. Lt. V. C. D. WILLIS, No. 109 Squadron.—In November, 1941, this officer was the captain of a Wellington aircraft. During a flight his aircraft was attacked by three enemy fighters and, although the aircraft sustained damage, including the rear turret which was rendered unserviceable, one of the attackers was shot down and a second one damaged.

Some days later, in the course of another flight, Flt. Lt. Willis's aircraft was engaged by a Messerschmitt 110, but, by skilful tactics, the attacker was driven off with its rear gun out of action. This officer has carried out a large number of operational missions, many of which have been of great importance. Throughout he has displayed keenness, courage and efficiency.

Capt. C. A. VAN VLIET, S.A.A.F., No. 1 (S.A.A.F.) Squadron.—In December, 1941, this officer led a formation of fighter aircraft acting as escort to a number of bombers detailed to attack Derna. During the operation a force of 12 enemy fighters was encountered, but Capt. van Vliet employed his formation with such skill that the bombers were defended from attack for nearly half an hour, while three of the enemy's aircraft were shot down, one of which was destroyed by Capt. van Vliet himself. This officer has performed splendid work in East Africa and the Western Desert during the last 17 months. He has destroyed eleven hostile aircraft.

F/O. K. G. HART, No. 250 Squadron—This officer has displayed great courage and skill in operational flying. In December, 1941, during a patrol, his squadron intercepted a force of 24 enemy bombers, escorted by 27 fighters. In the ensuing engagement F/O. Hart shot down two Messerschmitt 109s and several times prevented attacks on his fellow-pilots. He has destroyed at least eight enemy aircraft.

Lt. D. V. D. LACEY, S.A.A.F., No. 2 (S.A.A.F.) Squadron.—This officer has throughout shown exceptional keenness, dash and initiative. In December, 1941, whilst taking off, his aircraft was attacked by an enemy fighter. Skilfully overcoming the attacker's initial advantage, Lt. Lacey afterwards shot down the enemy aircraft. During many of the squadron's operational activities Lt. Lacey's aircraft has been subjected to simultaneous attacks by several enemey aircraft. Not only has he obtained successes, but he has many times prevented his formation from being attacked. Lt. Lacey has destroyed five enemy aircraft.

DISTINGUISHED FLYING MEDAL.

Sgt. R. K. WILSON, R.A.A.F. (R.A.A.F.) Squadron.—During the advance this airman participated in an operational sortie over the Sidi Rezegh area. His formation was attacked by a large force of enemy fighters and, in the ensuing combat, Sgt. Wilson destroyed a Messerschmitt 110 and damaged another. He then engaged and shot down two enemy army co-operation aircraft. This airman has destroyed eight hostile aircraft.

Air Sgt. R. ADDISON, S.A.A.F., No. 12 (S.A.A.F.) Squadron.—In December, 1941, during a bombing attack on Benina aerodrome, this wireless operator-air gunner was seriously wounded by fire from enemy fighters. Despite this, he bravely continued firing his gun until the attackers broke away. He then tended his fellow-gunner, who was also wounded, and, at the same time, made great efforts to obtain wireless contact with base. Throughout the attack and during the flight back to base Sgt. Addison's conduct was worthy of high praise.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED SERVICE ORDER.

Act. Wing Cdr. J. F. C. JENKINS, D.F.C., R.A.F.V.R., No. 114 Squadron.—In December, 1941, a low-level attack was made on the enemy aerodrome at Herdla. Despite the difficult contour of the Norwegian coastline, the exact target was skilfully located and, according to plan, was heavily and accurately bombed. Hits were scored on both runways, the wireless station, and on several aircraft on the ground.

The skilful and courageous leadership of Wing Cdr. Jenkins, so ably assisted by his observer, F/O. Brancker, both of whom devoted much forethought to the planning of the flight, was largely responsible for the complete success achieved.

BAR TO THE DISTINGUISHED FLYING CROSS.

F/O. H. P. BRANCKER, D.F.C., R.A.F.V.R., No. 114 Squadron.

For citation see Wing Cdr. Jenkins above.

P/O. T. J. W. WILLIAMS, D.F.C., R.N.Z.A.F., No. 109 Squadron.—In November, 1941, this officer was the captain of an aircraft carrying out an important operational mission. During the flight his aircraft was attacked by some eight enemy fighters and sustained severe damage. The front turret was put out of action, the wireless transmitter was hit, and other damage was inflicted. Despite this, by his skill and initiative P/O. Williams succeeded in damaging one of the enemy aircraft and completed his allotted task. This officer has shown exceptional coolness in the face of danger.

Sqn. Ldr. J. S. SHERWOOD, D.F.C., No. 97 Squadron.—In December, 1941, Sqn. Ldr. Sherwood and Flt. Lt. Mackid participated as leaders of formations of aircraft in a daylight attack on the battle cruisers *Gneisenau* and *Scharnhorst* at Brest. Extremely heavy and accurate anti-aircraft fire and opposition from enemy fighters was encountered, but although Sqn. Ldr. Sherwood's aircraft was hit several times by shell-fire, he skilfully kept his formation together and finally an accurate run was made over the target.

Flt. Lt. Mackid admirably supported Sqn. Ldr. Sherwood and pressed home a successful attack with great determination. Throughout the operation, which demanded a high degree of skill and courage, both these officers played a conspicuous part and contributed materially to the success obtained.

DISTINGUISHED FLYING CROSS.

Flt. Lt. J. G. MACKID, No. 97 Squadron.

For citation see Sqn. Ldr. Sherwood above.

P/O. G. C. BAYLEY, R.A.F.V.R., and F/O. A. G. MACLEOD, R.A.F.V.R., both of No. 7 Squadron.—During the past month P/O. Bayley and F/O. MacLeod, as pilot and navigator respectively, have carried out several attacks on the enemy warships *Gneisenau* and *Scharnhorst* at Brest. Despite arduous conditions and fierce opposing fire from enemy defences, the flights have been successfully accomplished, although on the last three occasions P/O. Bayley's aircraft has been damaged by enemy action.

Throughout these missions, which have entailed a high degree of navigational skill and expert knowledge, F/O. MacLeod has fulfilled his duties with conspicuous success. P/O. Bayley and F/O. MacLeod have always displayed great courage, skill and determination throughout the many sorties in which they have taken part.

P/O. G. H. RANGER, R.A.F.V.R., No. 250 Squadron (since deceased).—This officer has displayed courageous leadership and a fine fighting spirit. One day in December, 1941, during an engagement against a superior number of enemy aircraft, P/O. Ranger destroyed a Junkers 88 and a Messerschmitt 109. The following day his squadron formed part of a bomber escort in an attack on Derna. When the formation was attacked by enemy fighters, P/O. Ranger shot down one of them. Two days later, over Tobruk, his section encountered a formation of enemy fighters and bombers, and, in the ensuing combat, P/O. Ranger shot down a Messerschmitt 109F.

Sqn. Ldr. E. P. P. GIBBS, No. 130 Squadron.—This officer has been engaged on active operations over a long period and has participated in many sorties over France. During a sortie near Calais, in July, 1941, Sqn. Ldr. Gibbs was involved in combat with four enemy fighters and shot down one and damaged another of the attackers.

Since assuming command of No. 130 Squadron,

STRADDLED: An impression by Robert Aitchen of an attack on an enemy supply vessel by a Short Sunderland of Coastal Command. The bombs are carried internally on the Sunderland and run out on special racks under the wings.

SERVICE AVIATION

Sqn. Ldr. Gibbs has, by his excellent leadership and devotion to duty, raised the unit to a high standard of operational efficiency. In December, 1941, during a bombing attack on Brest, Sqn. Ldr. Gibbs probably destroyed one of three Messerschmitt 109s which attempted to intercept our bombers.

F/O. P. J. CUNDY and P/O. R. R. FABEL, R.A.F.V.R., both of No. 120 Squadron.—In January, 1941, F/O. Cundy and P/O. Fabel were respectively captain and navigator of a Liberator aircraft on patrol in the Bay of Biscay.

A Heinkel 115 floatplane was encountered and at once attacked. By skilful manœuvring F/O. Cundy enabled his gunners to bring effective fire to bear on the enemy aircraft, which broke off the combat and escaped into cloud with one engine on fire.

An enemy tanker with a submarine alongside was then sighted. F/O. Cundy immediately attacked the submarine with bombs and cannon fire and the submarine disappeared beneath the surface, leaving a large patch of oil. The tanker was then bombed and attacked with cannon fire. A second Heinkel floatplane which appeared was engaged and driven off with smoke pouring from it. F/O. Cundy then resumed his attack on the tanker with gunfire and scored many further hits.

Throughout, he showed great determination and devotion to duty and was ably assisted by the skill and efficiency of P/O. Fabel, who, on a previous occasion in bad weather, at night, was mainly responsible for the safe return of his aircraft when the wireless apparatus failed.

Act. W/O T. J. MYCOCK, R.A.F.V.R., No. 97 Squadron.—One night in January, 1941, W/O. Mycock was the captain of an aircraft which carried out a low-level attack on the battle-cruisers *Gneisenau* and *Scharnhorst* at Brest. The task demanded a high degree of skill and initiative and, although the night was extremely dark, W/O. Mycock finally approached the target in the desired direction. In spite of heavy opposition from the enemy's defence a daring and determined attack was made from a height of only 500ft. This non-commissioned officer has at all times performed his operational tasks with great keenness and enthusiasm.

DISTINGUISHED FLYING MEDAL.

Sgt. C. L. BRAY, R.C.A.F., and Sgt. D. W. SPOONER, R.A.A.F., both of No. 103 Squadron.—One night in January, 1941, Sgt. Bray and Spooner were captain and 2nd pilot respectively of an aircraft which participated in an attack on Wilhelmshaven. Sgt. Bray carried out a determined attack in spite of intense anti-aircraft fire, but, when making a second run over the target, a violent explosion shook the aircraft and an ignited flare was blown from the rear of the bomb compartment into the fuselage, where it set fire to the fabric, the floor and the beam gun seat. The aircraft was now brightly illuminated, so that it was an easy target and, whilst held in a concentration of some 30 searchlights, was subjected to intense enemy fire. The situation began to appear hopeless, and Sgt. Bray ordered the crew to escape by parachute. He then set the controls and, when making his way to the rear of the aircraft to ensure that the crew had left safely, he observed Sgt. Spooner still battling with the flames. Sgt. Bray thereupon returned to the control and skilfully and coolly extricated his aircraft from a perilous situation. The flare eventually burned its way through the floor of the aircraft and Sgt. Spooner, having exhausted the extinguisher, finally subdued the flames with his gloved hands. He then went forward and, to enable Sgt. Bray to fulfil the duties of navigator, took over the controls. Although suffering acutely from the effects of the fumes, he flew the aircraft safely back to this country. Throughout these airmen showed great courage and set an example worthy of the highest praise.

Flt. Sgt. C. HAW, No. 81 Squadron.—This airman has been employed on operational flying since June, 1940. He fought in the Battle of Britain, and since then he has participated in numerous convoy patrols and in escorts to bomber aircraft on daylight raids. He has destroyed three enemy aircraft. Flt. Sgt. Haw has displayed admirable qualities as a fighter pilot.

Sgt. P. E. MORIN, R.C.A.F., No. 76 Squadron.—This airman has carried out thirty-two operational sorties, including attacks on important enemy industrial centres and dockyards. He participated in two recent daylight raids on the enemy warships at Brest and showed great skill on both occasions. Sgt. Morin is a most determined and resolute pilot.

Roll of Honour

Casualty Communiqué No. 108

THE Air Ministry regret to announce the following casualties on various dates. The next-of-kin have been informed.

Royal Air Force

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Sgt. T. S. Dickson; Sgt. R. V. Gazzard; Sgt. G. P. F. Langdon; F/O. J. T. O'Brien; Sgt. J. E. Rose; Wing Cdr. C. M. Windsor.

The rear gunner of a Fairey Fulmar with his gas-operated Vickers K gun. Of interest is the manner in which the cockpit cover folds down.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. A. F. Buck; Sgt. L. L. Evered; P/O. J. S. H. Fairweather; Sgt. K. G. Gresty; P/O. I. McG. Pringle; Sgt. I. G. Sarjeant; Sgt. L. H. Wood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Allen; Sgt. G. A. Bennetts; Sgt. L. B. Box; L.A/C. T. W. Brown; P/O. A. D. Browne; Sgt. J. Claxton; Sgt. A. E. Coakes; Flt. Sgt. S. C. Cordy; Sgt. A. R. Cotterell; F/O. M. S. Ferguson; P/O. J. Gill; Sgt. S. Gordan; Act. Flt. Lt. R. A. Green; P/O. T. B. Grenon; Sgt. E. A. F. Grunsell; Flt. Lt. A. C. H. Haines; Flt. Sgt. A. Halfpenny, D.F.M.; Act. Flt. Lt. K. T. Hannah; Sgt. E. R. Harcourt; Sgt. J. Harding; Sgt. R. A. Hewlett; Act. Sqn. Ldr. P. H. Jackson; P/O. C. B. Jordan; P/O. N. H. C. Keable; P/O. L. H. Mercer; Sgt. J. Mitchell; Flt. Sgt. H. T. Naughtin; Sgt. R. Oldroyd; Sgt. G. Owens; P/O. L. A. Reeman; Act. Sqn. Ldr. B. J. Rogers, A.F.C.; P/O. M. A. Scott; P/O. I. O. MacK. Smith; F/O. W. M. R. Smith, D.F.C.; Sgt. P. McK. Southwood; Sgt. G. J. Talbot; Sgt. J. F. Walton; Flt. Sgt. R. Wordsworth.

WOUNDED OR INJURED IN ACTION.—Sgt. J. Devlin; Sgt. W. Hendrick; Act. Sqn. Ldr. T. M. Horgan, D.F.C.; Sgt. C. F. Lucas; Sgt. K. E. Robinson; Sgt. J. A. Rogers; Sgt. T. J. Ryder.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. C. T. R. Anderson; Act. Wing Cdr. M. H. Brown, D.F.C.; P/O. B. M. Cavan; F/O. P. S. Charles; Sgt. J. A. Groom; Sgt. J. J. Lammin; Sgt. A. L. Mills; Sgt. T. Robson-Scott; Sgt. P. A. Taylor; Sqn. Ldr. J. G. Walker; Act. Flt. Lt. H. D. Webber.

MISSING.—Sgt. S. Abram; P/O. R. Adcock; Sgt. E. A. Bailey; Sgt. F. E. Baldock; F/O. P. E. Bedell; Flt. Lt. W. E. Bowden; A/C.1 W. T. D. Burnett; L.A/C. A. H. Chapman; P/O. F. R. Clarke; Sgt. T. L. Clarke; Sgt. J. Crawford; Sgt. P. Eaton; P/O. A. M. Fisher; Sqn. Ldr. R. G. Forshaw; Sgt. B. Gray; Sqn. Ldr. T. Grier, D.F.C.; Sgt. A. O. Hawkes; Sgt. H. W. Hilton; Act. Flt. Lt. J. B. Hobbs; Sgt. S. E. Horsfall; Sgt. W. A. Hughes-Hughes; F/O. C. G. Imlay; P/O. C. L. Jenkins; Sgt. A. King; Sgt. F. G. Kipps; F/O. K. C. Kitto; Sgt. E. R. G. Lewis; Flt. Sgt. D. Martin; P/O. G. W. Morris; Sgt. J. Nash; Sgt. W. A. Nation; Sgt. F. Norman; Sgt. B. W. Palastanga; Sgt. P. G. Pearce; Act. Flt. Lt. G. Pelling; Flt. Sgt. J. K. Pollard; Flt. Sgt. R. J. H. Pyle; Act. Sqn. Ldr. J. L. Riley; P/O. J. H. Strong, D.F.M.; Act. Sqn. Ldr. A. L. Taylor, D.F.C.; Sgt. G. E. Thompson; Act. Flt. Lt. O. V. Tracey; Sgt. B. A. Webb; Flt. Sgt. W. E. Webb; Sgt. C. L. Wells; Flt. Lt. G. P. Westropp-Bennett; Sgt. B. J. Williams; Flt. Sgt. J. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—Flt. Sgt. R. B. Birtles; P/O. E. T. Bradford; A/C.2 A. Craven; A/C.2 D. L. J. Evans; A/C.2 K. Musgrove.

KILLED ON ACTIVE SERVICE.—Sgt. A. Bailey; Act. Wing Cdr. G. C. B. Bernard-Smith; Sgt. G. Boyle; Sgt. P. R. Chancellor; L.A/C. W. A. M. Davis; P/O. J. E. A. H. Fairfax, D.F.M.; Sgt. W. A. Fradley; F/O. N. I. C. Francis; Cpl. T. Gamble; L.A/C. P. Greene; Sgt. B. L. Grove-Palmer; Flt. Lt. J. J. Hamilton; Sgt. W. C. F. Harris; L.A/C. R. W. Hinde; L.A/C. S. Holden; P/O. D. H. Ivens; P/O. G. R. Lamb; Sgt. V. H. Langrish; Sgt. P. N. Linter; L.A/C. A. Lovell; P/O. R. Masters; Sgt. T. McK. Sinclair; P/O. E. L. V. Stanley; Sgt. A. Stather; Sgt. J. L. Sudders; L.A/C. S. B. Tebby; P/O. W. J. Turner; Sgt. E. Welch; W/O. S. C. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. W. C. Henning; P/O. T. R. Hodgson; Sgt. E. R. Peacock; Sgt. A. E. Sanne; Sgt. P. Savage; Sgt. J. F. Smith; Sgt. J. Whitbread.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Act. Sqn. Ldr. W. P. F. Treacy.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—P/O. W. J. White.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. R. C. A. Best; L.A/C. A. Bird; Sgt. T. D. Durrant; P/O. R. K. S. Harker; Sgt. E. N. King; Sgt. W. A. Lane; P/O. E. E. Sergeant; Sgt. F. Tolson; P/O. G. E. Tredwell.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 W. A. Elliot; A/C.1 E. G. Lenthall.

DIED ON ACTIVE SERVICE.—A/C.2 J. Costigan; Sgt. J. D. Martin; Sgt. R. M. Tait.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED PRISONER OF WAR.—A/C.1 J. A. Darragh.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 P. Hicks.

Royal Australian Air Force

KILLED IN ACTION.—P/O. J. A. Galvin; P/O. E. H. Lane; Sgt. L. Purves.

WOUNDED OR INJURED IN ACTION.—Sgt. N. Elliott; P/O. J. S. Mercer.

MISSING.—Sgt. R. T. Brewin; P/O. R. Devenish-Meares; Sgt. W. J. Dillon; Sgt. N. G. S. Drummond; Sgt. G. Hart; Sgt. D. G. Jack; P/O. R. J. D. Jeffries; Sgt. E. M. Lindsay; P/O. W. A. B. Logan; F/O. D. Rutter; Sgt. C. B. Treloar; F/O. M. H. Watson.

KILLED ON ACTIVE SERVICE.—P/O. R. W. Hopkins; P/O. J. M. McLaren; Sgt. W. R. Myles; Sgt. R. E. F. Sawyer.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. K. H. McNicol; A/C.1 W. N. Porter.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. K. N. Mansfield.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. M. A. Canty; Sgt. P. Comroe.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. H. R. Easton.

WOUNDED OR INJURED IN ACTION.—Sgt. H. A. Macleod.

MISSING.—P/O. I. W. Almquist; P/O. J. A. Bitcon; Sgt. W. G. Caldwell; Sgt. D. A. Court; P/O. H. F. English; Sgt. W. A. Evans; P/O. G. P. Ford; Sgt. D. G. Pettet; Sgt. W. Turley.

KILLED ON ACTIVE SERVICE.—Sgt. J. S. Bird; Sgt. A. C. Bone; Sgt. H. B. L. Gittins; Sgt. C. J. M. Howlett; P/O. J. Lynas; Sgt. D. R. McCullough; Sgt. D. L. Meisner.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. R. J. Jackson.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. S. C. Black.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. S. V. Crowhurst; Sgt. G. Morcom.

MISSING.—Sgt. W. E. Houston; Sgt. J. B. Leigh; Sgt. W. H. J. Milner; Sgt. C. J. Rudge.

KILLED ON ACTIVE SERVICE.—P/O. D. R. L. Brown; Sgt. D. J. Dempsey; Sgt. A. L. Sanderson.

SERVICE AVIATION

South African Air Force

KILLED IN ACTION.—Air Sgt. V. St. G. Brack; Lt. J. G. Ereaut; 2/Lt. C. N. Summersgill.

WOUNDED OR INJURED IN ACTION.—2/Lt. R. A. Joiner; Air Sgt. D. Newell.

MISSING, BELIEVED KILLED IN ACTION.—Air Sgt. T. B. Atkinson; Lt. T. T. Braithwaite.

MISSING.—Lt. D. G. Alexander; Lt. A. Benzie; 2/Lt. R. I. Burrage; 2/Lt. W. G. Cathew; Air Sgt. D. A. Chalmers; Air Sgt. G. J. De Klerk; Capt. J. H. Eccles; Major T. S. Fisher; Major M. H. Fowler; Air Sgt. A. Friedman; Lt. S. Goldfoot; Air Sgt. J. Hattingh; Lt. D. A. Hinde; Lt. Oberholzer; 2/Lt. K. H. O'Reilly; Lt. T. L. Parry; Lt. W. G. Parsons; Air Sgt. J. E. Phelps; Air Sgt. S. Radomsky; Major R. J. Stewart; Air Sgt. W. D. Tucker; Air Sgt. R. Viljoen; Air Sgt. F. B. White; Lt. L. D. Wood.

Casualty Communique No. 107

THE Air Ministry regret to announce the following casualties on various dates. The next-of-kin have been informed.

Royal Air Force

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—Wing Cdr. D. F. Balsdon; Sgt. R. T. Bray; Sgt. E. R. Budgell; Sgt. W. Dodds; P/O. C. A. G. Ferguson; Sgt. L. W. Jones; Sgt. F. Y. D. Kerr; Flt. Lt. J. E. Lambert; Sgt. V. S. Lewis; P/O. R. H. Matthews; Flt. Sgt. G. E. A. Pendrill, D.F.M.; Sgt. R. C. Wood; Act. Flt. Lt. R. A. Wright.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. H. Challis; Sgt. J. V. Clegg; Sgt. T. A. H. Drysdale; Sgt. S. T. F. Edwards; P/O. D. Irving; Sgt. B. E. Sale; P/O. P. H. Slater-Eiggert; Sgt. F. Stephens; Sgt. C. Wilkinson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. R. Adams; Flt. Sgt. R. I. H. Aird; Flt. Sgt. K. C. Amy; Sqn. Ldr. A. G. G. Baird; Act. F/O. J. du V. Broughton; Flt. Sgt. T. O. Burgess. D.F.M.; Act. Flt. Lt. J. Curchin, D.F.C.; Sgt. H. Douglas; Sgt. W. D. Edge; P/O. T. Fairhurst; Sgt. E. C. Findon; P/O. R. Goulding; Sgt. G. K. Grainger; Sgt. J. Hadfield; Sgt. C. W. Hall; Sgt. E. Hollinghurst; Sgt. R. H. Jordan; P/O. J. C. Lynn; Sgt. J. M. McIlwraith; F/O. D. Mackay; P/O. M. I. A. Mendoza; Sgt. W. R. Moore; Sgt. D. Morrison; P/O. C. A. Newman; Sgt. K. T. Noakes; Sgt. R. A. Pickers; Flt. Sgt. A. P. Price, D.F.M.; Sgt. E. J. Rapley; F/O. W. C. Rasbary; F/O. M. V. Redfearn-Smith; Sgt. C. Rhodes; Flt. Sgt. W. G. Rogers; Sgt. J. A. Rudkin; Sgt. L. Smith; Sgt. N. H. Thomas; Sgt. L. S. Thorrowgood; Sgt. C. G. Todd; Act. F/O. P. B. Verver; Sgt. H. V. Wansbrough; F/O. W. F. Ward; Sgt. R. C. Watkins; F/O. S. P. Watkins; Sqn. Ldr. R. E. Weld.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. H. P. L. White.

WOUNDED OR INJURED IN ACTION.—Sgt. F. H. Baren; Sgt. H. Bolton; Sgt. A. E. Clarke; P/O. J. H. Day; P/O. H. P. Lardner-Burke, D.F.C.; Sgt. T. C. M. Marshall; Sgt. W. Middlemiss; Sgt. J. L. P. Pate; Sgt. J. R. Sutherland; Act. Flt. Lt. T. A. Vigors, D.F.C.; Flt. Lt. D. R. Walker; Flt. Sgt. I. M. Williams.

MISSING, BELIEVED KILLED IN ACTION.—F/O. C. H. Anderson; Sgt. D. A. Brunton; Sgt. D. W. Buck; Sgt. J. Evans; P/O. R. E. Sellar; P/O. E. E. Steele; Sgt. F. Thompson.

MISSING.—Sgt. G. Anderson; Sgt. R. A. P. V. Atkinson; F/O. P. R. Bellamy; Sqn. Ldr. R. C. Bisset, D.F.C.; Sgt. C. J. Bourner; Sgt. H. H. Brown; Sgt. C. V. Catherall; Sgt. W. P. Dales; Sqn. Ldr. W. A. A. De Freitas; Sgt. W. L. Evans; Sgt. R. D. Gracie; Sgt. G. F. Halliwell; Sgt. M. Hogarth; Sgt. R. Howells; P/O. J. B. King; Sgt. D. McLaren; Sgt. W. Oates; L.A/C. J. Oldfield; Sgt. T. J. Pearce; Sgt. R. S. Prior; Sgt. R. J. Pulham; Sgt. H. Rose; Sgt. R. F. Rudee; Sqn. Ldr. C. D. S. Smith, D.F.C.; Sgt. L. W. Stammers; Sgt. A. H. Taylor; P/O. D. Woodcock.

KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—A/C.2 T. Broom; P/O. W. R. Constable; Sgt. R. K. Cook; P/O. H. R. Cutten; Sgt. J. A. Denning; P/O. A. L. Edwards; Cpl. T. P. Farr; Act. F/O. E. A. F. Gibb, D.F.M.; Sgt. H. A. Godsmark; Flt. Sgt. A. G. Graves; Cpl. J. A. Hancock; Sgt. H. W. G. Hewitt; L.A/C. R. D. Hiles; Sgt. L. Hogg; Sgt. S. A. Holland; Flt. Sgt. L. J. Kuhrt; L.A/C. D. F. Leman; Flt. Sgt. C. D. Mace; Sgt. S. R. Mayston; Sgt. L. Merrifield; Act. Flt. Lt. R. F. Owen, D.F.C.; Sgt. R. H. D. Palmer; L.A/C. D. W. Parrett; P/O. G. H. Ranger; Sgt. S. C. Rhynas, Sgt. G. H. Savoy; Flt. Sgt. C. Stow; Sgt. C. J. Stuart; P/O. M. B. Van-Heerden; A/C.1 R. F. Watson; Sgt. E. C. Welsh; P/O. A. H. Wilkinson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.2 J. H. Bateman; A/C.1 J. R. Brand; L.A/C. H. Broadhurst; L.A/C. R. E. Brodie; Sgt. R. F. Brooks; A/C.2 R. D. Coombes; A/C.1 J. T. Farquhar; A/C.2 F. K. Faulkner; Flt. Lt. R. W. Gautrey; L.A/C. C. F. Harrison; A/C.2 C. Holland; L.A/C. S. Hooper; Act. Sqn. Ldr. A. S. Lee; Sgt. L. Littlefair; A/C.1 H. S. McKeown; P/O. K. G. A. Marsh; A/C.1 B. J. Messer; Flt. Sgt. G. E. Morrison; A/C.1 H. Paisley; A/C.1 D. H. J. Peppercorn; Cpl. E. C. Pittaway; Sgt. G. Pooch; Flt. Sgt. E. C. Reed; Cpl. H. V. Richmond; A/C.1 F. B. Rose; Flt. Lt. C. MacK. Scrutton; A/C.1 E. Shipman; A/C.2 W. H. Smith; A/C.2 D. E. Turner; A/C.2 W. F. Turner.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 O. T. Archer; Sgt. D. H. Barlow; Sgt. J. P. Bentley; A/C.2 T. Butterfield; A/C.2 G. J. Carpenter; Cpl. J. W. Dawson; Cpl. C. H. Edmonds; P/O. G. Fisher; A/C.2 E. G. Harvey; A/C.2 J. Hughes; A/C.2 M. L. Jackson; L.A/C. G. H. Johnson; Flt. Sgt. A. W. Jones; Sgt. G. Owen; A/C.1 P. J. Shepherd; L.A/C. J. L. Smith; Sgt. H. S. Thomas; Cpl. W. McG. Wilson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. J. L. L. Arthur; A/C.2 T. J. Barrah; A/C.1 W. Boal; Sgt. F. G. Bowman; Sgt. R. J. Clark; Sgt. M. T. Garfit; L.A/C. A. J. Headland; L.A/C. J. H. Hill; L.A/C. N. R. Hughes; L.A/C. L. Stock; Sgt. J. E. Wilson.

DIED ON ACTIVE SERVICE.—Sgt. F. Armitage; A/C.2 D.L. Bamber; A/C.2 A. E. Blake; A/C.2 F. W. Bodden; Flt. Sgt. P. E. Clark; Act. F/O. J. A. Cunningham; A/C.1 T. J. Edmonds; Cpl. W. Gallacher; A/C.1 F. Mason; L.A/C. H. E. R. Smith; A/C.1 T. Torbett; L.A/C. J. H. Trandell; A/C.1 G. R. Wade; A/C.1 J. Whitford; L.A/C. A. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Cpl. H. L. Barber; A/C.1 A. Vernall; Sgt. W. A. Weaver; A/C.2 W. G. White.

Royal Australian Air Force

MISSING.—P/O A. J. Cain; P/O. E. A. Magor; Sgt. T. B. Macliver; Sgt. E. H. Schrader; Flt. Lt. A. M. White.

KILLED ON ACTIVE SERVICE.—P/O. C. R. Digan, D.F.C.; P/O. J. E. M. Dixon; P/O. H. B. Rowland.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. C. Leagh-Murray.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. V. C. Akes.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. H. Bischlager; Sgt. J. L. Gibson.

WOUNDED OR INJURED IN ACTION.—Sgt. G. H. Niblo.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. D. C. Newsome.

MISSING.—Sgt. L. S. Barker; Sgt. J. S. Caldenwood; Sgt. C. M. Complin; Sgt. C. E. Hillmer; Sgt. A. J. Knight; Sgt. A. P. McLean; Sgt. R. F. Mann; P/O. R. A. Mather; Sgt H. A. Stasiuk; P/O. J. McG. Taylor; Sgt. R. L. Thompson; Sgt. J. L. Vaughan.

KILLED ON ACTIVE SERVICE.—Sgt. S. D. Fanjoy; P/O. V. E. Friesen; Sgt. J. A. Stewart.

DIED ON ACTIVE SERVICE.—Sgt. G. C. Bailey.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. E. E. Stewart.

MISSING.—Sgt. G. M. Goldfinch; P/O. G. E. Guthrie; Sgt. D. R. White.

KILLED ON ACTIVE SERVICE.—P/O. R. P. W. Barker; P/O. W. S. Beattie; F/O. D. M. Poynter.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. H. A. Read.

MISSING.—Lt. M. R. Bour; Lt. G. A. Chalkley; Air Sgt. A. B. Le Roux; Air Sgt. L. D. Shanley.

A member of a Stirling's air crew takes a rest on the couch provided for this purpose. It is situated between the front and rear spars where they pass through the fuselage.